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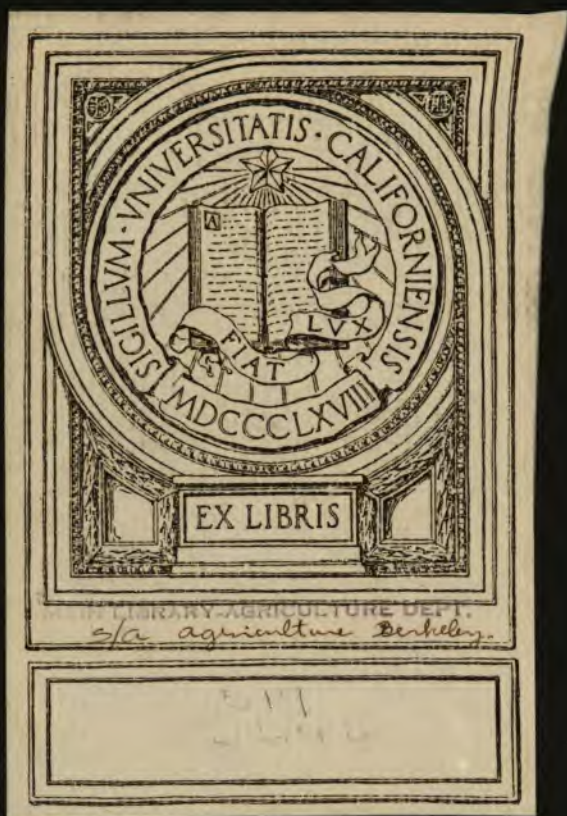
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INTRODUCTION

During the past thirty years, I have devoted much time and energy to the cultivation and improvement of the Chrysanthemum and have received many inquiries from those desirous of gaining knowledge on this subject. Confronted with these facts and realizing the urgent need for a complete, as well as practical treatise, at a price within the reach of all, I make this attempt in compliance with these demands.

It is my desire to concisely set forth in these pages all details pertaining to Chrysanthemum culture, beginning with stock plants, treating the many branches, through each stage of development, up to and including the staging of plants and cut blooms.

Most of the works upon this subject have been confined to methods practical only to florists, having every facility necessary to successful culture.

The amateur, growing a few plants for pleasure and eager for better results, has been entirely overlooked. It is hoped this booklet will meet the requirements of all.

There is no plant which responds more freely to careful attention than the Chrysanthemum. The whole secret of success lies in prompt attention to details, and when these are thoroughly understood and executed, we may expect a generous reward.

The celerity with which the first three editions sold has prompted my issuing this Fourth Edition. I trust that my efforts will be assistance to many.

ELMER D. SMITH,

*Member of the Chrysanthemum Society of America
The National Chrysanthemum Society of England, and
Society Francaise des Chrysanthemistes.*

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Smith's *Chrysanthemum* *Manual*

CHAPTER I.

HISTORY

The derivation of the word *Chrysanthemum* is from the Greek words *Chrysos*, gold—and *Anthemom*, a flower. It is not easy to say how long the *Chrysanthemum* has been known to mankind, but undoubtedly over 2,000 years have elapsed since it was first known in the Celestial-Empire.

In Japan its cultivation can be traced back over 700 years. Breynius, in 1689, was the first European to mention the *Chrysanthemum* under the name of *Matricaria Japonica Maxima*. M. Pierre Louis Blancard introduced the first large flowering varieties into England in 1789, and the following year they were flowered and named. Mr. John Salter was one of the earliest English hybridizers, and produced many wonderful varieties from 1838 to 1848.

As near as can be ascertained, they were introduced into America about the year 1847: Dr. H. P. Walcott is credited as being the first person in this country to raise new varieties from seed, which he did as early as 1879. The work of hybridization was taken up by Wm. K. Harris and John Thorpe early in the 80's.

Their efforts were crowned with great success, both originating many new and startling varieties. These results were incentive to others until the zenith was reached in 1894, when 163 new varieties were offered for sale, many of which were inferior to those then in commerce. This condition caused many to be skeptical, doubting the merits of the so-called novelties, until fully tested.

In the meantime, John Thorpe had conceived the idea of organizing a society to protect the interests and also promote the development of this flower which was fast gaining popularity. In 1890, at Buffalo, the organization now known as the *Chrysanthemum Society of America* was established. In 1894 this Society appointed committees composed of experts to meet during the following season at Chicago, Cincinnati, Philadelphia, New York and Boston, to inspect seedlings and sports. These

committees have been continued from year to year, awarding first-class certificates to the deserving ones.

Such action brought the varieties certificated into prominence, and those which failed to meet their commendation were so little sought after as to be unprofitable, and many discontinued hybridizing.

The first exhibition given by the C. S. A. was in November, 1902, under the auspices of the Horticultural Society of Chicago. Since then they have been held annually in the large cities both East and West.

CHAPTER II.

STOCK PLANTS.

At the close of the flowering season the old plants must be saved for stock, from which to propagate young plants for another year's use. Each grower should decide how many will be required and provide the most suitable situation for their maintenance.

The amateur will need only two or three of a kind, while the commercial florist may need several thousand of the most popular sorts to meet his demand. Some varieties are more susceptible of being increased than others, making cuttings abundantly and rooting freely.

Those who propagate for their own use only, should keep the plants in a low temperature, just above freezing, and even a few degrees of frost will not materially injure them. They thrive best when kept on the dry side during the dark days of winter, at which time they are rather inactive. The florist who requires quantities for early distribution will be obliged to give higher temperature, about 50 degrees; and their needs for water should be carefully considered, avoiding, if possible, too abundant and frequent use, as such a course tends to weaken the plants, thus giving sickly cuttings.

Another plan adopted by many private gardeners and those requiring only a limited number of plants, is to root sufficient cuttings in November and dispense with the old stock plants.

Early Propagation—Stock plants for early propagation are generally planted on greenhouse benches, producing successive crops of cuttings. With the new and scarce sorts it is sometimes advisable to take cuttings even as early as September or October, and, as soon as rooted, these are planted in shallow boxes or upon the bench. When large enough, the tops are taken off as cuttings. This induces the plants to make new breaks, which are used for cuttings when of suitable size.

Cold Frames—The cold frame system is the most practical for those who do not have greenhouses, and the wholesale florist who needs large quantities of plants for June and July delivery will find them equally serviceable.

In the construction of cold frames, there is no objection to excavating one or two feet, provided ample drainage can be secured; otherwise it is best to make board frames and plant stock on the level or slightly elevated so that no surplus moisture will remain about the roots. Stock thus stored should be protected by covering the frames with boards. To prevent continual freezing and thawing, these frames must be covered with coarse manure or litter. Most varieties are not injured by freezing, provided they are kept in this condition until spring.

Field Grown—Field grown stock is in every way more satisfactory

than that which has produced blooms under glass. They appear to possess more vigor and give successive crops with greater rapidity. These may be handled in cold frames, as previously mentioned, or removed to greenhouse when early propagation is necessary.

Imported Stock—Those importing foreign varieties often find them in very poor condition when unpacked. This is not to be wondered at when we consider they are from two to six weeks in transit. They are generally packed in dry cocanut fiber, and when taken from the box look like dry sticks. It is only by the utmost vigilance and care that such plants are nursed into activity. Immerse them into tepid water for a few hours to plump the wood and roots.

After removing all lifeless growth, pot them in light soil, using as small a pot as will accommodate the roots. It should be the aim to induce root growth as soon as possible and, to do this, plunge them into a close case which is provided with gentle bottom heat—about 70 degrees will suffice. See that the material in which they are plunged is kept on the dry side, and use water rather sparingly until they begin to grow freely. They should be looked to several times each day, and if the plants or soil shows signs of fungus, ventilation must be given for such conditions, if not promptly checked, are fatal. It is often wise to remove the cuttings when quite small and root them, especially if the old plants are weak or show signs of decay.

By taking this course it is possible to establish a small plant upon its own root, which would otherwise be lost if allowed to remain until the old plant had gained vigor.

Novelties and Scarce Sorts—Novelties and scarce sorts are often bought in limited quantity to propagate from. The best results are obtained by planting these young plants into flats (shallow boxes), or upon the bench in shallow soil. As soon as they show signs of growth, the tops are taken as cuttings and the plants are treated thereafter same as stock plants.

It is imprudent to over-propagate, by taking every cutting as soon as large enough to root; better let the cutting get strong, so that a few leaves are left on the plants. This will greatly assist in maintaining strong, healthy stock plants.

CHAPTER III.

PROPAGATION

Assuming the old plants (stock plants) have been cared for and are in proper condition, the next step is the propagation of young plants. This is best done with soft wood cuttings or divisions; the former, however, are generally used.

Cutting Bench—The cutting bench is simply a table or bench constructed to hold three or four inches of material into which the cuttings may be inserted. Clean washed sand is considered the best material, but when unavailable, coke, brick or stone, finely crushed and screened, will give very satisfactory results. After the bench is filled with sand, it should be pounded as firm as possible and given a thorough watering when it is ready for use. In preparing these benches, see that all material is clean and free from decaying matter, and to this end a coat of white-wash will be beneficial.



FIG. 1. CUTTING BENCH TAMP.

Selection of Cuttings—In the selection of cuttings, it is generally conceded the strong and vigorous are the best. Stock properly handled will give good cuttings, and we would take weak ones only when absolutely necessary.

Making Cuttings—These are cut from an inch to three inches long, removing the lower and shortening the tips of the larger leaves. See Fig. 2.

With a knife make a cut in the sand $\frac{3}{4}$ in. deep, or more, according to length of cuttings, inserting close together and firm the sand well about them. Give the whole a liberal watering and keep constantly wet until rooted, which will require six to twenty days.

To insure the largest percentage, the cuttings should be moderately soft at the time they are removed from the plant. Single eye cuttings of new and scarce sorts may be used when necessary. These are fastened to toothpicks with fine stemming wire, allowing half of the toothpick to

extend below the end of the cutting, which should firmly rest on the sand when inserted in the bed. See C, Fig. 2. It requires more time to produce

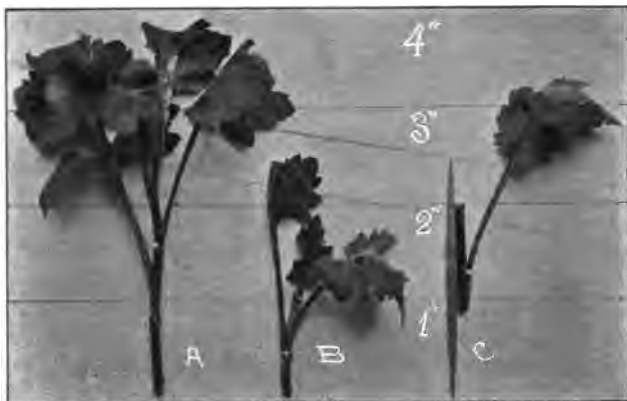


FIG. 2. CUTTINGS—A, LONG; B, SHORT; C, SINGLE EYE.

good plants by this system then where fair-sized cuttings are taken, but is often of service when stock is limited.

Air and Temperature—The propagating house should be well aired, and as far as possible the atmospheric temperature should not exceed 55 degrees, with a bottom heat of 10 degrees higher.

The Chrysanthemum is so susceptible of being rooted that no fast rule can be given. They may be struck in a temperature as low as 40 and as high as 80 degrees, but if the former is adopted they root very slowly, many varieties become hardened and thus the object is defeated. On the other hand, if too high temperature is used, cutting bench fungus is liable to set in and ruin the crop.

Shading—As the season advances and the outdoor temperature rises, it is impossible to maintain 55 degrees, and the soft cuttings are very much inclined to flag or wilt. For this purpose we use a light wrapping paper, in rolls 30 inches wide, which is given a coat of linseed oil and then tacked to the sash bars of the house. This shading being semi-transparent, gives satisfactory results throughout the propagating season.

In case of an excessive bright and hot spell, whitewash or any other good shading material should be applied to the outside of the glass. Let the condition of cuttings be index for shading, but use every precaution necessary to prevent wilting, exclude light by covering and dampen the walks to lower the temperature.

Watering—It is very important that cuttings should never get dry, for under such conditions the end inserted in the sand becomes brown and hardened and will not take up water in sufficient quantity to revive the foliage, and thus becomes worthless. Many of the wholesale florists propagate Chrysanthemums the year round, although the bulk are struck from March to July.

Another method largely employed in California and other sub-tropical states, is to use cotton cloth as a covering for the propagating house or frame. This excludes part of the light and prevents the wind from drying them out. The cutting beds are usually made upon the ground, using sand as a material to hold moisture and sustain them until they make roots. Large quantities of cuttings are successfully handled in this way along the Pacific Coast.

Saucer System—Those who wish to propagate a few plants and are not favored with the facilities of the greenhouse, may use shallow boxes or any dish that will hold a few inches of sand. A dozen or more cuttings may be inserted at a time by adopting the "Saucer System" given by Peter Henderson in his work, "Practical Floral Culture," which is as follows: "It is called the Saucer System because saucers or plates are used to hold the sand in which the cuttings are placed. The sand is put in to a depth of an inch or so and the cuttings are inserted in it close enough to touch each other. The sand is then watered until it becomes the condition of mud, and placed on the window sill fully exposed to the sun. But one condition is essential to success, until the cuttings become rooted the sand must be continually saturated and kept in the condition of mud; it once allowed to dry up the whole operation will be defeated."

English Method—The English method may also be of service to the amateur and is as follows: Insert three or four cuttings around the edge of a four-inch pot that has been previously filled with light soil, consisting of loam, sand and leaf mould, equal parts. These are placed into a close frame and given same attention as suggested for Imported Stock, pg. 4.

Divisions—In localities where the plants remain out-of-doors over winter without injury, they can be increased by removing the sprouts or stools that have sprung up from the base of the old plant. As these stools come into active growth, roots are formed near the surface of the soil, and may then be removed and replanted or potted as desired. Often such pieces are difficult to pot owing to the long, crooked stems. These are removed, leaving a few roots to establish the young plant. New varieties are generally produced by seeds, which are fully treated in Chapter XII.

Potting—Cuttings should not remain in the bench after the roots are half an inch long, as they are potted easier, making better plants in every way than when allowed to remain until the roots are further developed.

The soil should not be dry, but moist enough to remain intact when squeezed in the hand, and, on the other hand, not be muddy. Cuttings are usually potted in small pots, the two-inch size being ample. Put sufficient soil in the bottom of the pot so that the base of the cutting will be about $\frac{3}{4}$ of an inch below the surface, hold cutting in center of pot with one hand and fill in with the other. Firm the soil, with thumb or fingers, enough to keep the cutting upright, and be sure to leave sufficient space for water, which should be applied liberally without delay.

Putting the cuttings in flats (shallow boxes), instead of potting, has long been in vogue, and is a good course to pursue, insuring good stock at planting time with less labor involved. See Fig. 3.

CHAPTER IV.

SPECIMEN PLANTS*

Cuttings may be taken any time from January 15th to March 15th, but those struck in February give best results. As soon as rooted they are potted in 2-in. pots, using light soil, and placed in a cool, airy house and as near the glass as possible. If given proper attention, such plants will



FIG. 3. STOCK GROWN BY FLAT SYSTEM.

make large specimens from three to six feet high, and nearly as wide, by flowering time. In the course of a week or ten days the roots will push to the side of the pot and will need shifting into the next larger size.

Soil—There are many ideas as to what soil is best suited for Chrysanthemums. Each expert has a way of his own in preparing the soil, but as equally good results have been obtained under varied conditions, it is safe to conclude that the compost employed has little to do with results, provided it contains sufficient food to nourish the plant and the cultivator is a close observer, considering the conditions under which they are grown.

All concede that fresh cut sod piled late the preceding fall with one-fourth of its bulk of decomposed manure, makes an excellent compost.

Repotting—Turn out the plants, take them with the left hand and place in the new pot (which is generally an inch larger than the one from which they were removed) so that the ball is a half an inch below the rim

*This chapter is largely writings which have appeared in the American Florist and are from T. D. Hatfield, Wellesley, Mass., who has been eminently successful in this important branch of chrysanthemum culture.

of the pot and the plant stands in the center. While held in this position fill in sufficient soil and firm gently with a stick around the pot, until it is filled level with the original ball of earth. If the soil is retentive and rather wet, the ramming process can be carried to extremes, but if of a light nature, it should be made rather firm, and when the final potting is done, it can scarcely be carried to excess.

Stopping—The term “stopping” means pinching out the center of a shoot, and the object is to force the plant to make several growths instead of the present one.

When the plants are established in four-inch pots, they are generally from four to six inches high, and at this stage the pinching and stopping begins. This should be done a few days before repotting or deferred until after the plants have made roots into the new soil. This induces the plant to make several side shoots, and as soon as these have attained four or five inches in length they are again stopped. This work is repeated throughout the season up to August 10th. Some of the varieties may be stopped a trifle later, but each cultivator must know the flowering time of those under his care. The early varieties set bud earlier, and it may be wise to discontinue stopping some of these as early as August 1st. By April 1st to 15th the plants should be in full vigor and ready to shift into six-inch pots; with this potting use a richer soil by adding to the ordinary compost a dusting of wood ashes, and a little pulverized sheep manure. The latter should be used in very small proportions.

Drainage—Free drainage is essential and we would recommend charcoal to be used for such varieties as are liable to burn. Coal ashes are also a good material for this purpose and may be used as advantageously as broken crocks. Pot firmly when the soil is light, and loosely when the soil is heavy. At this stage the plants are carefully observed, their manner of growth noted, also tendency to break, and liability to disease. The good as well as the bad points are almost certain to appear during April, and only such as promise well are shifted up to the largest sizes. Some of the varieties have the habit of setting premature buds at this stage of growth. Such conditions are unfavorable to the production of fine specimens, although the greater majority will outgrow this defect after the blooming period has passed.

From 1st to 15th of May another shift will be necessary and this time into seven or eight-inch pots, according to the varieties. The weaker growing should be put into the smaller size, and the stronger ones into the largest. As the plants at this season begin to assume some size, and owing to the higher temperature which prevails, the watering will need constant attention. In repotting at this time, the plants should be set low enough in the pot to allow ample space for water, not less than an inch, but better an inch and a half, to hold sufficient water to saturate all parts of the soil.

Final Potting—The final potting occurs from June 1st to 15th; for this give a richer compost, using a rather rough open soil containing a large portion of broken, half-decomposed sods. This must be packed

more firmly in the pots. A close, heavy loam is bad, but if it must be used, it should be only lightly firmed; sufficient sharp sand may be used to keep the water passing out freely.

Watering—All experts agree that the plants should never suffer for want of water, and consider it one of the most important details in all stages of development. On the other hand, it is very important that the drainage be ample, so that the water passes through freely, thus preventing stagnation, a condition conducive to disease, which will finally result in failure.

It sometimes occurs that the exact condition of plants in pots is not fully indicated by the appearance of the soil. A very accurate course to follow is to rap the pots with the knuckles or a stick; those that are wet have a dull sound, those that are dry a hollow sound. A few days' trial will teach the operator to detect the difference in sound in an instant.

Staking—During August many of the plants will have attained considerable height, even though they have been stopped every few days. Those which are inclined to make too dense growth should be provided with a few stakes and the branches gradually tied out to the desired form, thus making a foundation to build upon later. These stakes will need to be removed later on, and replaced by larger ones, when it is determined how tall the plants are likely to grow.

Early in September it will be necessary to consider the final staking and tying out. The main object in specimen plants is to develop as many growing shoots as possible before the middle of August, arranging them so as to keep the plants even and regular in form. How this is to be done is somewhat a matter of taste, but it is easier to do it all at once, as more shapely plants can be formed. If the plants are desired for exhibition purposes and to be transported some distance to the exhibition hall, the stake system is preferable to that of the wire frame, the advantage being that plants tied to stakes can be drawn together so there will be no friction, and at the same time occupy much less space.

The best course to follow in the matter of staking and tying largely depends upon the size and form to which they are to be trained. The Japanese growers shape their plants into many artistic designs, such as crosses, fans, boats, parasols, etc. When such forms are to be perfected, it is necessary to make a temporary frame-work of wire or stakes to which the shoots may be tied out into the form desired, and this should be provided before the plants attain any great size. The forms generally adopted for exhibition groups are round and slightly elevated in the center, as shown in Fig. 4, page 12, and are grown all sizes from three to six feet in height and nearly as wide.

The operation of staking is simply placing stakes into the soil, the outer ones at such an angle as to bring the branches in the desired position to give the plant the required diameter. Additional stakes are supplemented to hold the inner branches in position.

The best material for trying is silkline, which does not slip; being soft, does not injure the shoots, and as its color is green, is not so conspicuous as where white string is used.

Tying out should not be left too long; in fact, it should be done every few days. There are always some overgrown, vigorous shoots which are difficult to accommodate, but while supple they will bend easily. A bad hole or open space can sometimes be filled by these strong growths, bending them down and tying securely. When specimen plants are grown for conservatory decoration, or where they can be practically transported to the exhibition hall, the wire frames may be used.

When wire frames are used, tie as many shoots as possible to the lower part of the frame, as the greatest danger is congestion at the top.

Disbudding—The operation of disbudding will need attention early in September, the early varieties setting buds first and the later ones following, according to the natural flowering time. For early exhibitions, say the 1st of November, buds should be prominent by September 15, and showing color four weeks later. At least three weeks are required after they show color until maturity.

Generally all the specimen plants produce terminal buds; each shoot bearing a cluster at the extremity, which is disbudded so as to leave only one bud to each, and this the center one. In this way the flowers are uniform in size, and if the plant has been well trained and tied out, these individual blooms will nearly touch each other.

After setting buds, the plants will begin sending out suckers from the roots in all directions, which, if allowed to remain, rob the buds of the nourishment which has been provided for their development. These should be removed at once and this operation repeated as often as they appear, as well as any lateral growths which may start from the shoots.

Feeding—The application of stimulants requires careful consideration and should be entrusted only to persons of judgment and discretion. With the roots so much confined in the pots, even more care is required than where the bench system is employed in the production of cut blooms.

The pots must be filled with roots and the drainage perfectly free to begin with. If cow manure is used as a top dressing, would be best to dry it first and afterwards break into small pieces. This acts as a mulch and fertilizer at the same time. As a safe and lasting stimulant, pulverized sheep manure is preferred, which should be applied in the form of a top dressing, adding a little sandy loam to keep it open. Liquid manure may also be used if the plant continues healthy, applying once a week at first and twice or three times a week later. Sulphate of ammonium and nitrate of soda are sometimes used with wonderful results, but must be applied with discretion.

From the time the buds are set, success depends very much upon the judicious use of fertilizers, either in liquid form or a top dressing. Some plants will take liquid manure in liberal amounts; others, if so treated, are easily injured. Over-feeding shows itself in yellow, stunted foliage. When this occurs, use clear water and let them get as dry as they can with safety.

The grower needs to be acquainted with the plants as with individuals: it is a matter of experience and, when carefully done, may be continued

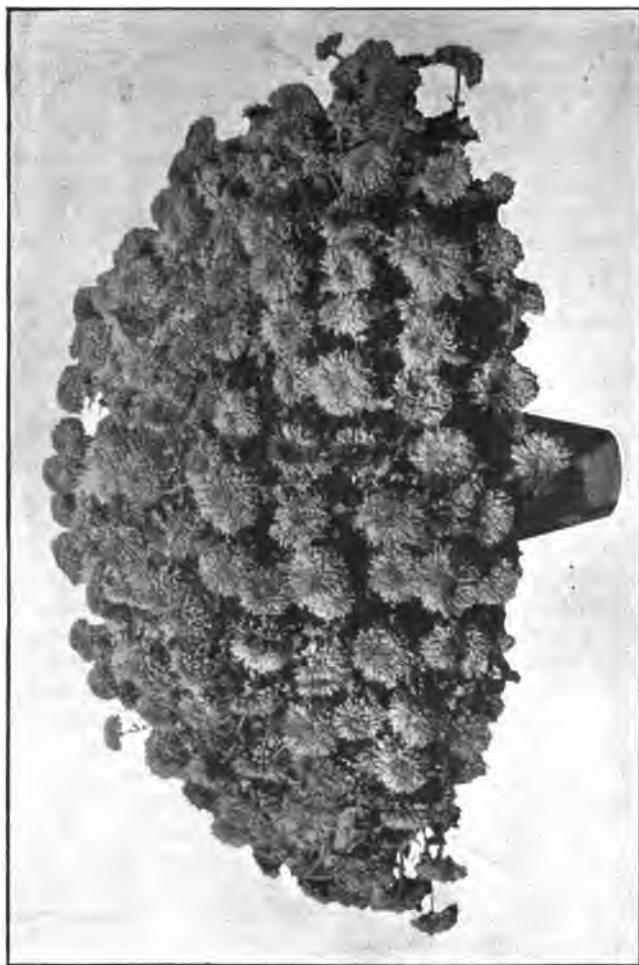


FIG. 4. SPECIMEN PLANT AS GROWN BY I. L. POWELL, GARDENER TO SAMUEL THORNE, ESQ., MILLBROOK, N. Y.

until the buds show color. It is, however, worthy to note that pink and red varieties, including bronze, show lack of color and also burn easily if feeding is continued too long. Clay's fertilizer is a good manure and perfectly safe to use either as a liquid or top dressing mixed with a little loam. Soot water at times and weak lime water will sweeten the soil.

The drainage must, however, be kept free, and this is sometimes difficult at the end of the season, when the pots are filled with roots. Punching holes through the ball to the drainage will generally relieve water-logged plants.

CHAPTER V.

MISCELLANEOUS PLANTS

Standards—The cultural directions given for specimen plants will be suitable for this purpose. The greatest difference being the training allowing them to grow without stopping until they have attained the desired height. Standards are generally about five feet to the lower branches,



FIG. 5. MARKET PLANT

although there is no fixed rule on this subject, and they may be grown any height, from three feet (which are termed half-standards,) to the height mentioned above. It is necessary the cuttings be propagated early. When needed, provide with one strong stake for each plant, to which it is tied to keep the stem straight. As soon as they reach the desired height pinch out the center. The several breaks which follow form the foundation for top or head of the standard. These are nipped every few days the same as specimen plants. The training will require

some care and attention as well as disbudding, feeding and other details.

For Market—Dwarf plants of symmetrical form, with foliage down to the pots, are the most salable, and when thus grown require constant attention as to watering and stopping, allowing each plant plenty of room to keep the lower leaves in a healthy condition. Cuttings taken June 1st and grown on, either in pots, planted on old carnation benches, or in spent hot-beds (light soil preferable) and lifted by August 15th will make very nice plants $1\frac{1}{2}$ to 2 feet high. The reason for lifting early is to have them well established in their flowering pots before the buds are formed.

Another system is sometimes employed which gives very symmetrical plants and often utilizes considerable stock that would otherwise be worthless. Cuttings that were struck late in June and potted in two-inch pots may be put several together in one pot about August 1st, provided they are in thrifty condition. Three plants to a five-inch pot and

five or six to a seven-inch and so on. By sorting and placing the taller in the center and shorter at the edge, very symmetrical plants may be had. Disbudding and feeding will need attention to assure best results.

Single Stemmed—The same culture as given for market plants will suffice for this class, except they are generally grown in pots and restricted to one stem and flower. Those from one to two feet in height are more effective and useful than taller ones; for this reason many prefer plunging out-of-doors where they will have full benefit of the sun and air, making them more dwarf than when grown under glass.

Cuttings rooted early in June are best for this purpose. They must be repotted, staked and tied as their needs demand. In July the final potting takes place and the soil should be made very firm to secure short-jointed growth.

Miniature—There has not been much attention given to this class in this country, although cultural directions are given in many of the old English works.

The best time to take cuttings is from the first to the last of August, according to the earliness of the variety. They are taken at the period when the buds are just beginning to form and if delayed until very far advanced, the wood becomes hardened and will not root freely. These cuttings should be potted immediately into light soil and placed in a close frame which has been made the same as a hotbed with fresh manure to give forth a gentle bottom heat.

In selecting cuttings take strong shoots from plants in the open border or those grown under glass, and if the selection is made from those which naturally do not grow high, so much the better. A 3 to 3½ inch pot is large enough for this purpose. After the cuttings have been plunged therein they must be covered with a sash and shaded to keep out the strong light. It is also advisable to spray them over two or three times a day which will maintain the most genial condition for root formation.

As soon as rooted (which may be ascertained by turning them out) air should be given the frame, a little at first and increasing every few days, to gradually harden the plants to a natural condition. In this manner plants can be had 8 inches high with blooms 5 inches in diameter.

For Cut Flowers—The pot system is employed by all English growers and doubtless most of those on the Continent. Culture, same as for Market or Single Stem as far as training is concerned, shifting from time to time as directed for specimen plants. Propagation may take place from February to May, according to the variety and requirements of the cultivator. Throughout England these plants are potted and plunged in the open border as soon as danger of frost is over, and could be so treated in this country if it were not for the ravishes of the Tarnished Plant Bug, which is so numerous.

If exhibition blooms are desired they may be grown to single stem, or stopped early in June, saving three breaks which are grown on, each to produce a flower later.

Grafting—There are two objects in grafting chrysanthemums, first, to increase the vitality of weak growing varieties by grafting upon strong kinds. Second, to display a number of varieties on one plant at the same time. To the experienced gardener this art is of little or no interest, but to the novice there is something wonderful in the sight of a plant having a dozen or more distinct varieties flowering simultaneously. Such plants attract a great deal of attention at the exhibitions.

Where it is the desire to increase the vitality, cuttings are struck in the autumn or winter months, and grown on in a cold greenhouse until early spring. These are used as stock upon which to graft, and should be done in March or April. Select scions from the weak growing kinds and cut the end in the form of a wedge. After cutting out the top of the stock an inch or so above the ground, make a slit an inch in depth in the stump and insert the wedge shaped scion, tying securely in place with raffia or light cotton yarn.

It is necessary that the wood of both stock and scion be in a half-ripened condition, reasonably firm, and if possible have both the same size. In case it is impossible to find scions of the same diameter as the stock, the scion should be set to one side of the incision so that the bark of both will be even on one side. A moist, warm corner of the greenhouse or any place where a close atmosphere can be maintained for a few days will be necessary to insure their uniting. If the weather is warm and the sun very bright it is sometimes advisable to shade the plants to prevent scion from wilting, and occasionally sphagnum moss is wrapped around the union and the foliage moistened to prevent rapid evaporation. As soon as the scions become established, which is generally in the course of eight or ten days, the tying material can be removed and the plants given more air, receiving the same care and attention as other plants.

For grafted specimens it is important that all the varieties should flower at the same time, and to secure maximum effect some thought should be given to arrangement of the colors. The most showy specimens are produced by grafting upon strong growing standards, using one variety to each shoot. All lateral growths or breaks starting out of the stock should be removed as fast as they appear.

In Open Border—Most of the previous forms of plants may be grown in the open border with fairly good success. The essential points are that they be planted on light soil which permits of their being taken up without breaking away too many roots. If large specimen plants are to be treated this way, ample space must be given so they do not become crowded, and afford the operator room to attend to stopping, etc.

The lifting and potting should be done not later than August 15th, so that the plants will become well established in their new quarters before buds are formed. After potting it is necessary they have a copious watering and be set in a sheltered place out of the sun and strong drafts as much as possible. An old shed that will afford some light is a very suitable place.

From this time on little water will be required at the root until they

have become thoroughly established. It will be advisable, however, to dew over the foliage several times each day to prevent flagging. As soon as established; give light, gradually increased each day until they can stand full sun.

Hardy Chrysanthemums—Most Chrysanthemums are hardy out-of-doors in the northern states with slight protection as far as their roots are concerned, but fail to be satisfactory owing to early frosts which ruin the buds when in a half-developed condition. The most serviceable varieties are the early flowering Pompons, which perfect their flowers before frost. Many of the later ones can be used to advantage in the southern states, or in localities where severe frosts are not expected until the middle of November.

CHAPTER VI.

PACKING PLANTS

For Express—For shipments not requiring more than five or six days to reach destination, pack in wooden boxes that have been previously lined with paper or other material to keep out the frost. The plants should be thoroughly watered, turned out of the pots and wrapped tight in some sort of pliable paper to keep the earth intact. With a light coat of excelsior on the bottom of the box, the plants are then placed in rows close



FIG. 6. BOX OF PLANTS

PROPERLY PACKED.

together on their sides, with ball of earth next to end of the box. This is followed by another row in which the ball is placed next to that in the first row, the operation being repeated until bottom of the box is covered. In putting in the next tier, reverse them, beginning at the other end and so continue until finished. The main object is to pack securely, preventing them from shifting, even though roughly handled. Any intervening spaces between the plants and side or top of the box should be filled with excelsior, sawdust, or some other material, so that if the package is turned upside down they cannot move about. (See Fig. 6.)

Inexperienced packers invariably fail in this respect and often when the plants reach destination they have so shifted in the box as to be entirely destitute of soil, as well as badly broken. See to it that they cannot move.

Each variety must be labeled and some means provided so that the recipient can unpack without danger of getting them mixed. A system many have adopted is to wrap one, two, three or four plants of a kind into a bundle, each bundle being provided with a label, and are thus packed. Where five or more of a kind are ordered they are separated by a sheet of paper.

In very severe weather it is sometimes necessary to wrap the boxes with several thicknesses of paper as a safeguard against frost. In very warm weather the foregoing method is impractical, as they are likely to heat and thus be ruined. From May to October the plants are generally

wrapped and set upright in shallow boxes which have been provided with a post in each corner to which cleats are nailed. Then slats are placed an inch apart to form the cover, thus assuring a free circulation of air.

For Mail—In packing plants for mail shipments the soil is washed from the roots, these are then wrapped in damp moss and wax paper in small bundles, containing not to exceed 25 in each bundle. These are generally labeled with a tough paper label and packed in parafine lined boxes or those made of corrugated board. All unoccupied space must be filled firmly with excelsior or similar material.

For Export—In packing for export there are two systems employed, one for the winter months, when they are packed tight, and the other for summer, which should provide light and air to the plants. When packed close, excessive moisture is to be strongly guarded against. Under such conditions the plants are sure to rot if they are to remain packed more than six days. There is sufficient moisture in the plant itself to retain vitality for some time, and whatever is used to fill up the intervening spaces should be perfectly dry. Moss, excelsior or cocoanut fiber are the best materials for filling.

Plants that are to be exported should be put into a cold, airy house for a week or ten days and watered very sparingly so as to harden the wood, as they usually perish in transit if the growth is soft. Before placing in the boxes remove most of the foliage as it is very apt to die and cause decay. The balls of earth should be wrapped in dry moss and tied securely. Place the plants in an upright position, on the bottom of the box, using a cleat to each row; to hold them secure. If the weather is severe, protection against frost will be necessary, and may be provided as previously described.

In hot weather the same method is employed with the exception that damp moss is used, wrapping each ball with wax paper. Holes are bored through the sides of the box to admit light and air. The holes are generally covered on the inside of the box with galvanized wire screen to keep mice from girdling them while on ship-board.

Small foreign shipments are sometimes made by removing the soil and placing the plants in tin boxes, filling the intervening spaces with dry cocoanut fiber or moss. It is very important when packed in this manner that all the leaves be removed except those undeveloped at the top. If the plants have been hardened there will be little loss. It is easy to test any system of packing, by preparing a shipment, and lay it away for a period equal to that required in transportation, after which it may be opened and the condition of the plants carefully noted, or if desired pot them to ascertain how many will survive.

CHAPTER VII.

COMMERCIAL FLOWERS.

The general public do not consider the difference in character of the many varieties now grown, but admire them for the beauty displayed. With the Florist it is far different as he raises flowers for the sole purpose of placing them on the market from a remunerative standpoint and thus should be familiar with their merits and defects.

Commercial varieties are those which possess the desired qualifications and characteristics to meet the demands of the grower, wholesaler and consumer.

Those most in demand are of easy culture, growing only to a moderate height (not to exceed four feet) and produce flowers of pleasing colors. White is probably in greatest demand, next comes yellow, then pink; with a decided preference to those which are most pure in their respective color tones.

Red and bronze are grown in comparatively small quantities.

Form and substance are both given consideration; those that do not ship well are soon condemned.

When the stock is to be handled through the commission houses and reshipped to the retailer, the incurved varieties generally stand the handling with least injury.

As a rule the Foreign varieties do not meet the requirements of the commercial grower. It is imperative they be planted early, selecting crown bud to secure double flowers. If planted in July very few of those from abroad can compare with American sorts. The reason is obvious.

The Foreign raisers of seedlings, reserve those which produce the largest flowers—irrespective of other characteristics, as the exhibition class is most in demand.

In America the bulk of the plants sold are those having commercial merit, hence those interested, select from their seedlings those producing the most pleasing colors, best foliage with strong, erect stems in preference to size alone.

The grower who invests largely in foreign sorts, with the expectation of superior quality of salable stock, is prone to disappointment. Inability to plant early, as well as failing to give as close attention to details as the exhibition expert can, are the causes of the grower's downfall.

The length of time required to produce the crop, whether the desired date of flowering be early, midseason or late and the quality of blooms best suited for the grower's trade, are matters which must receive consideration before selecting the kinds and deciding upon the best cultural methods.

As the vigor of the plants has much to do with the quality of blooms, we would recommend planting stock of midseason kinds from 2-inch pots

early in June (early and late varieties will be treated under separate headings). Cuttings struck early in April should be in fine condition for June planting, nine inches apart each way is about the right distance. If the demand is for medium rather than large flowers they may be stopped, allowing two or more breaks to grow on, each to make a bloom.

Soil—Fibrous sods cut 3 inches thick and piled grass side down the preceding fall with one-fifth their bulk of half decomposed manure makes an excellent compost for filling the benches. If it is heavy clay some sharp sand should be added to increase the porosity.

Four or five inches of soil in the bench is the right depth, the former preferable. When planting firm well around the plants, leaving a slight



FIG. 7. BENCH OF "IVORY" TIED TO WIRES.

depression to receive the first few waterings, the object of this course is to keep the soil from becoming sour. As soon as there are signs of active growth which usually requires about two weeks, the water should be increased gradually until the whole is thoroughly saturated.

Fresh cut sods are equally serviceable provided they are properly handled. If cut as directed three inches thick, one thickness may be laid grass side down and the remainder of the bench space filled with fine soil, or they may be run through a sod crusher, placing the coarser part at the bottom and the fine on top. If either these methods are adopted a light covering of manure may be placed on the bottom of the bench before filling. We have grown thousands of fine blooms without the use of manure, relying upon light applications of chemicals as the plants required it. Fibrous sods supply abundance of humus which is so essential to plant life.

Tying—As soon as the plants are 8 inches in height some arrangement must be made for staking and tying. There are several systems:—

dwarf, short-jointed varieties, like Merza and others, may be tied to wires running full length of the row, supplying additional wires when required. See Fig. 7.

Some use stakes fastened at the top to a wire stretched tight over each row. Most commercial places use the twine system, which consists of two wires, one over each row of plants and the other a few inches above the soil. Two-ply jute twine is cut the proper length and tied to top and bottom wire. To this twine the plants are tied as often as required. See Fig. 8.

Watering—From this time on the principal detail is watering, which requires constant attention and whosoever has this charge must rely on his own discretion. The plants being vigorous, will use up quantities of water each day and from this time until the flowers are cut they must not



FIG. 8. BENCH SHOWING PLANTS TIED TO TWINE.

suffer for the want of it. At the same time we must guard against overdoing, particularly is this the case with many of the weaker growing sorts which suddenly tell us of our mal-treatment by the foliage beginning to turn yellow, showing a sickly appearance. The best remedy is withholding water, not to a degree that will injure the plant for want of it, but sufficient to restore its normal condition. Let the appearance of the foliage be an index to the supply of water.

As long as the foliage is luxuriant and healthy in color we may feel assured that the supply of water is not in excess of their demands.

To maintain these conditions it is important that all dry spots in the benches be thoroughly watered before spraying the plants.

Those who prefer to do watering and spraying in one operation should walk backward, watering the dry spots as they appear and then do the spraying. If the spray reaches the dry spots their identity is lost and thus are passed by without fully saturating.

Spraying—Spraying overhead will be necessary to keep Red Spiders in check, which are very hard to control. This process will require some judgment, for if repeated too often or late in the day it is apt to cause rust and other diseases. There is not so much danger during the hot summer months, but from August 15th to flowering time no water should be applied after 3 p. m., so that the plants will be perfectly dry by night. (See diseases.)

Airing—The chrysanthemum does not enjoy a close, stuffy atmosphere, hence an abundance of air during the growing season is important.

Not only during the day but night also, at all times unless the building is in jeopardy from approaching violent storms.

Shading—A few years ago it was considered necessary to give a light shading through the summer months to Chrysanthemums planted under glass. This is hardly necessary in most localities, as shorter jointed plants and firmer wood result from full exposure to the sun.

At the approach of color it is quite important the pink and red varieties be partly shaded from the direct rays of the sun, as these colors seem to be easily faded. There may be localities where this would be unnecessary, but in the middle states it often continues warm and bright into October and such precaution is necessary to secure color of the highest degree.

Scalding—After a few days of dull weather (which makes the growth unusually soft), followed by very bright sun, the young tips sometimes scald or burn. In such cases use every effort to prevent them from wilting. Frequent spraying will keep the atmosphere charged with moisture and be very beneficial. Should this fall, apply a light shading of clay to the glass. This is prepared by adding sufficient clay to water to make it muddy and applied by spraying over the roof. It is unwise to use a permanent shading, and the one suggested will disappear with the first shower or by spraying.

Feeding—All plants are sustained by the constituents of the soil of which Nitrogen, Potash and Phosphoric Acid are the chief elements.

What effect each of these factors have upon the construction of the plant and its florescent need not be discussed at this time. When these nutritive ingredients are exhausted, liquid applications are given to supply their needs and it is this operation to which the term feeding is usually applied. The effect of such applications are revealed by the appearance of the plants and the resultant flowers thus produced. From this it is evident that what actually takes place in this construction of plant life is very obscure, hence we must be governed wholly by observance, determining their needs by what is presented to us in their growth.

There are several ways to reach this desired end, viz: first top dressing

with manure, the strength of which is taken to the roots in liquid form by the application of water. Second, by extracting the soluble parts of manure, diluting to the desired degree and applying in solution; third, the use of liquids made from soluble chemical salts. All three methods are equal as far as producing the desired crop is concerned provided they are judiciously applied, but there is a marked difference in the cost of material and labor involved. The present price of manure, the labor required to make it accessible to the plant far exceeds the cost of chemicals.

Stable manure contains $1\frac{1}{4}$ per cent plant food (by Government Analysis), or 25 pounds per ton, while some of the highly concentrated chemical fertilizers now on the market contain 65 per cent actual plant food. It requires $2\frac{3}{5}$ tons of manure to supply the same amount contained in 100 pounds of such chemicals and when we consider the labor required to handle this quantity of manure when used as a top dressing or reduced to a liquid, even the casual thinker is confronted with the question—why all this unnecessary expense? The experimental station have taken up these matters in detail and set forth in their reports that chemicals are equal to natural manures in the production of crops.

We use a mixture known as Chrysaline, one pound of which is as efficient as 80 lbs of manure. The former is perfectly soluble while the latter must be leached in some way before it is available, one is clean and odorless as so much salt, the other dirty and offensive when manipulated in any form. The strength of chemicals are known quantities and constant, while manures are uncertain and variable.

Chemical Fertilizers—In the case of chemical fertilizers most of the failures are due to too strong application. A few years ago we were using Chrysaline at the rate of 1 ounce to 6 gallons of water, but recent observa-

tions indicate it should not be used stronger than 1 to 10 and when the soil contains considerable manure 1 to 20 or 30 gallons gives far better results when used before the buds are selected. Some will consider this a very weak solution, but experience has shown it sufficient and the old adage "better be safe than sorry" will be appreciated by those who use such concentrated chemicals indiscriminately.



FIG. 9. APPEARANCE OF FOLIAGE WHEN OVERFED.

Once a week is as often as it should be applied to most varieties and never when the plants show signs of dryness. A very good plan is to go over the benches and water all dry spots before applying. It is a great temptation to those who

have not used chemical fertilizers to over do. It must be taken into consideration when feeding solutions of any form they are taken up through the roots, and the process of assimilation immediately follows.



FIG. 10. BLIND GROWTH
FROM EXCESSIVE NUTRIMENT.

Food applied in this way is more available than any other, and herein lies our great danger; we are applying a solution that is colorless, odorless and tasteless, having every appearance of water.

Liquid Manure—Liquid manure was in use many years before chemical fertilizers were known and in the hands of the inexperienced is much safer. There are so many ways of formulating liquid manures that it is impossible to give a definite rule with assurance of having the best. Those of experience know by the color when it is safe to use, but such knowledge is difficult to impart to others. The following rules are considered safe: $\frac{1}{2}$ bushel of horse or cow manure to 1 barrel of water. These proportions are practically 1 pint to the gallon, so that those requiring a small quant-

ity can make to suit their needs. Sheep manure is strong and will require $1\frac{1}{2}$ barrels of water for the same quantity. Hen and pigeon manures are excellent, but being very strong are safest when used in weak solution, and should not exceed 1 pound to 10 gallons.

In preparing these liquids the manure is generally put in a coarse burlap bag, allowing it to soak for two or three days. A box or barrel may be filled and water applied, leach fashion, but the liquid thus obtained is very strong and will need diluting. An old rule is to dilute to the color of weak coffee, but this is hardly safe as some of the strong manure give light colored liquids.

As we know little regarding the strength of solutions made from material at our disposal, the subject is more or less a matter of guess. Fine blooms may be obtained by their use, and by closely observing growth of the plant and quality of flowers it will soon be apparent how to use for best results.

Where the soil is fairly rich with manure there is little or no need of feeding until after they have been disbudded. If resorted to at all, the applications should be very dilute or the plants will become too gross at this period, which is marked by the thick crisp or harsh feeling foliage.

When a leaf pressed between the thumb and finger cracks and will not return to its normal position it is evident the treatment has been too

generous. Such conditions frequently cause some varieties to become blind, that is the joints do not elongate but form a compact mass of foliage at the top of the stem and literally refuse to produce buds. In either case it is best to discontinue feeding, so that nature may help to rectify this error.

Lime—Lime and iron enter into the construction of the plant to a limited degree, but both of these are generally found in sufficient quantities in most soils. Lime acts as a decomposing agent, liberating ammonium and minerals contained in the compost, and has a decided solidifying effect upon the plant tissues. It is best applied by dusting air-slacked lime lightly over the surface of the bed and should be rubbed in with the hands or slightly raked before water is applied, otherwise it becomes hard and is of little value.

Iron—Iron may be applied in the form of iron filings as a top-dressing or incorporated in the compost, at the rate of a pint to the bushel, or by dissolving a half-ounce of sulphate of iron (copperas) in five gallons of water and apply this solution. It may be added in small quantities to chemical or manurial liquids.

Burning and Damping—Experience teaches us that the red varieties and more sensitive and first to show this defect. Some of the pink and white and occasionally a yellow burn or damp when conditions are favorable. From the fact that flowers produced under ordinary cultivation are seldom thus affected it is quite apparent that the concentration of food to the petals is the main cause and this is augmented by excessive heat and moisture.

To avoid such conditions put on full air early in the day and if possible do all the watering at this time, so that the plants and atmosphere may become thoroughly dry before night.

In very damp weather it is sometimes necessary to turn on a little heat to keep the air dry and buoyant, even if the temperature does not demand it.

The accumulation of food elements in the petals beyond a certain amount are transformed by chemical action of heat or dampness into an acid, which dissolves the tissues. Why this defect is so apparent in some varieties and not in others we are unable to say, unless lacking in the quality of substance. Get varieties thus inclined into active growth, and discontinue feeding after the buds become half developed. They may lack a trifle in size, but be consoled by the fact that your flowers are not ruined. Some competent growers advocate the use of charcoal dust mixed in the soil as a preventive.

Top-Dressing—If the details given have been attended to, in the course of six to eight weeks the stock will be making rapid growth, and the roots extending to all parts of the soil. At this period they will require some additional food and a light top-dressing of manure from spent hot-beds in a half rotted state, or dry pulverized cow or sheep manure may be used to advantage.

If the stock has been planted by May 15th, this operation will take

place early in July, and 30 days later the second top-dressing may be applied. If the planting does not occur until the first week of June, we would advise giving the first top dressing second or third week of July, and second the third week of August, provided the plants are in a healthy, active state and appear to need further encouragement.

While top-dressing is very beneficial, it has one disadvantage, and that is covering the soil so its condition cannot be readily determined by the eye. Some use three inches of top-dressing and apply it all at once. Watering under such conditions and do justice to the stock is difficult, as it must be done by guess or the soil under the dressing be carefully examined; it may be dry in places and wet in others. By making the manure fine, adding and thoroughly mixing an equal amount of loam, will furnish material for an excellent dressing. This can be easily distributed on the benches any desired thickness, in accordance with the needs of the variety being treated, or in consistency with the strength of the material used.

If sheep manure is used one inch of this mixture is ample for the vigorous kinds and less for the weak ones. When horse or cow manure is used $1\frac{1}{2}$ inches will be about right. This should be firmed down to come in close contact with the soil. In this way the dry spots will be come apparent on the surface of the beds, which is the only object of this process.

If fine manure is not at hand and that of a coarse nature is substituted, it should be placed between the rows leaving some space next to the plants uncovered so the condition of the soil can be detected at a glance.

Removing Stools—Plants that have been top-dressed soon throw up stools or suckers from the ground. These should be removed as soon as they appear, care being taken not to injure the roots in so doing. This operation should be repeated from time to time as necessity demands.

Buds—In this branch of chrysanthemum culture there is little necessity that any great knowledge be acquired regarding the two forms of buds, crown and terminals.

Those interested in this subject see buds and disbudding next chapter.

It matters little whether the bud selected is crown or terminal. The important knowledge to acquire is, what date gives the best flower.

The bulk of chrysanthemums planted for commercial use do not set early crowns, owing to late planting. Some make second crowns late in August, and those planted in July give terminals in September and October.

It is for this reason the mastery of these obscure terms are unessential.

All that the Commercial grower needs to know regarding this subject may be summed as follows: Buds of Early varieties planted during May and June should be selected from August 10th to 25th.

Midseason kinds Aug. 25th to Sept. 10th and the late sorts, Sept. 20th to Oct. 10, according to when the buds are apparent and of sufficient size to admit of disbudding.

The dates given are resultant of many years' records and adequate.

Buds of new varieties, or those which have not been tested, should be selected at intervals of five days, from Aug. 20th to Sept. 10th, attaching a tree label with the date it was retained. If the flower is single an earlier date may remedy this defect and if too double or poor in color a later date may be beneficial.

Such a course is the only way to become familiar with this prominent feature and a record of the results should be filed for future reference.

At flowering time it is easy to determine the best dates, and in making these deductions, let purity of color be fully considered. The various dates at which the buds of the white varieties are selected, will have no material effect upon the color.

Decided variations are noticed in the pinks and yellows and the greater the different in date of selecting the bud, the more contrast. The least permanent color is pink and it is intensified or reduced by variance in such conditions as heat, air, sunlight and date of buds.

Flowers from early buds are the lightest, and those from latest buds, darkest in color, provided other conditions are equal.

Yellow is not so easily affected by conditions, although some varieties described as yellow will become bronzy on late buds. When the flowers are developing, an abundance of air, a light shading, to exclude the bright sun, and a late bud, will give the highest color and best substance.

Each grower must decide the best date for selecting buds, as the conditions he maintains may be somewhat at variance with those of others.

Late buds develop more rapidly than the early ones, in fact there is very little difference in the maturity of those selected August 15th, and September 5th, provided they are the same variety.

Should the late buds intensify the color too much, giving the pinks an objectionable purplish hue, and the yellow come bronzy, it would be better to decide upon an earlier bud for future crops, providing the other qualities are equal.

The date of the buds also has effect on fullness and size of the flowers. The early buds give the largest flowers, and are more double, but the petals are narrow compared with those from later buds.

The flower buying public insist that the stems be of good length and well clothed with foliage. All concede those produced from terminal buds are of brighter color and amply provided for as far as foliage is concerned, also much easier managed than the crowns.

Early—Since publishing the second edition of this work the flowering season has advanced two months. This is due to the introduction of Golden Glow and Smith's Advance, both of which may be had in bloom from July to October, according to when they are planted and date the buds are selected. Formerly all varieties flowering by October 15th were considered early, but at present such should be termed semi-early.

Those desiring flowers prior to October should arrange to bench the plants in April or early in May, which would necessitate the cuttings being put into sand in March, securing buds in June, July or early August, according to when they appear. Should the early or crown bud develop

too early on Smith's Advance, it may be removed and the next one secured, but Golden Glow usually produces buds as soon as the benches are filled with roots, and the lateral growths which follow the early bud terminate in a cluster of terminal buds so that the removal of the early bud will not greatly retard the flowering season. With this variety the date of planting should be considered before hand if the crop is desired at a certain time. From past experience we would suggest planting in early May for flowers late in August and early September, and early in June for late September crop. By planting every two weeks from May 10th to June 25th, succession may be had from August 20 to late October.

Such semi-early varieties as Monrovia and October Frost should be planted early in May if September flowers are desired and buds selected soon after July 15th. Both of these varieties produce rather thin flowers when planted late or where the later buds are retained.

The slow development of these early buds gives size and fullness that cannot be otherwise obtained. We can not too strongly impress the importance of early planting, all kinds that are needed before November 1st, and it should be the endeavor to have them benched early in June at the latest. It is foolish to expect early flowers from late planted stock, even though the varieties are naturally early flowering.

Late—For late flowers select varieties which naturally mature late, and keep them in a growing state as long as possible. To secure late buds give a liberal amount of water and at the approach of cold nights lessen the supply of air; this will tend to keep the growth soft. The mid-season varieties planted late in July or early August are usually satisfactory. When this plan is adopted do not use very rich soil and withhold liquid fertilizers until disbudded, otherwise they are apt to come blind. Buds secured from October 1st to 15th will perfect flowers between Thanksgiving and Christmas.

Height of Plants—It is sometimes advantageous to take crown buds rather than terminals, owing to limited space between bench and glass.

To know the height a variety will attain at maturity is important, particularly when head room is limited. If records have not been kept it is wise to confer with those who give these matters constant study and can suggest varieties suitable for the purpose.

When to Cut—At what stage of development the flowers should be cut is perplexing to some. The petals have more substance when fully matured, and for this reason most varieties should not be cut before center petals are developed. This gives greater depth, adding to finish of blooms, as well as increasing the keeping qualities and are thereby in better condition to stand the wear and tear of shipping and handling. It is allowable to cut early varieties unmaturing, if fancy prices result therefrom, otherwise it is best to let them stand. Varieties having open centers when fully developed may also be cut premature. All blooms should be stored in water at least 12 hours before sending to the market.

CHAPTER VIII.

EXHIBITION BLOOMS

The term Exhibition Blooms refers to the varieties which are most serviceable in displaying the greatest development of size, and as size is the chief characteristic considered, many of the best kinds for this purpose are of little consequence to the commercial grower. There are a few possessing commercial qualifications which are of sufficient size to be of some importance at the exhibitions, especially where the schedule calls for 25 or more blooms to be shown on long stems in one vase. In such competitions rigid stems with an abundance of foliage close to the blooms often so enhance the exhibit as to merit the award over those having greater size, but deficient in stem and foliage. Such varieties as Betsy Ross, W. H. Chadwick and its several sports, Timothy Eaton and Yellow Eaton, etc., are well adapted to this purpose.

In beginning this chapter we wish to impress upon the reader the fallacy of laying down hard, fast rules, for many of the best growers obtain satisfactory results under a system of their own or at least attribute their success to certain methods not usually followed, and yet equally good results are reached by other courses. The first steps necessary in the production of the largest and finest blooms is to establish strong, vigorous plants and maintain this condition throughout their existence. Lack of water, food, light and air or an over supply of water and food are debilitating. There are two systems which may be employed --one to plant upon benches, as directed in preceding chapter, and in pots similar to the method followed by the gardeners of England. The only difference is they plunge their plants out of doors until the approach of the flowering season, while we grow them under glass entirely. This system is looked upon with favor by most of the private gardeners in this country.

It is conceded that early propagation is essential if we excel in this undertaking, as a long period of growth seems to impart greater vigor. Cuttings should be started in February or early March at the latest. When rooted, pot into small pots and keep in a cool, light and airy house. A low temperature, 40 degrees or as near as possible, is preferable to exciting growth, with greater heat. A light, friable soil (decomposed sods preferred) containing one-fifth of its bulk of well-rotted manure and half this amount of half-decayed leaves that have been rubbed through a screen, is requisite.

Bench System—Assuming the cuttings have been rooted and potted into small pots and placed in a cool place, watering and giving all the air possible is all the attention required for the next few weeks. As the roots come through to the sides of the pots they will need shifting into the next size larger. If they are first in two-inch pots, three-inch will be required for the first shift and 2½-inch in 3½-inch or 4-inch. When propagated in February it may be necessary to shift again in still larger sized pots to prevent them from becoming pot bound and thus check their growth.

Soil—Complete directions on this subject given in the preceding chapter are applicable here as well as the preparation of the benches.

Planting—Those who have houses of sufficient height and can plant by May 15th, doubtless have best results inasmuch as the plant has a longer period of growth and becomes thoroughly established.

As to depth of soil it may be from four to six inches, the former preferred, as there is less liability of its becoming sour by overwatering before the plants are well established. When the benches are made ready and filled, the next step is to decide how far apart they shall be planted. There are many opinions upon this subject, and without question the best results are obtained where ample room is given for full development by free admission of air. Ten to twelve inches apart each way is little enough; much depends upon the size of the foliage. In planting, firm them well, leaving a slight depression around each plant to receive the first few applications of water, but do not wet entire until the plants make new roots and are strong enough to utilize all the soil.

This condition is apparent at the pushing forth of vigorous growth which indicates a corresponding strong root action. At this stage the whole soil should be watered.

Firming—After the plants begin making rapid growth, go over the bench with a brick or heavy mallet and firm the soil, so that the original four inches will not exceed three when firmed. If of a porous nature it can scarcely be overdone, but if stiff clay, caution is advisable lest the drainage be impaired. By planting in shallow soil and firming it well, conditions are established very similar to those of the pot system, which will produce short-jointed plants.

Tying—The directions given Commercial growers will here suffice. Those who prefer stake instead of twine can stretch a wire three feet above the bench over each row and tie wire or bamboo stakes thereto, to which the plants are tied as soon, and often, as their growth requires support.

Buds and Disbudding—At just what time to save the buds is ever a very perplexing problem to the expert, inasmuch as climatic conditions have a great deal to do with the results. The change of temperature

which takes place in the autumn months has a tendency to ripen or solidify the wood, and is immediately followed by bud formation. In the northern hemisphere this change generally takes place from the 1st of August to the 1st of September, according to location. Those living at a high altitude or adjacent to large bodies of water are first to feel the change, hence are favored with early buds. In the southern hemisphere this change takes this reason the chrysanthemum flowers in Australia during the months of March and April.

Having set forth these facts that climatic conditions are instrumental in bring about this desired bud state, we must all consider our own locality and be governed accordingly. Some of the experts secure buds on some varieties as early as the first of August, and get magnificent blooms therefrom. Doubtless they have solved the problem, as far as they are concerned, but there are others not so favored. We doubt if those located in the middle states where the heat continues through the month of August and sometimes into September, would find such an early date practical, unless for some of the early varieties which naturally set early buds.

In this locality (Southern Michigan) best results are from buds taken August 25th, or soon after, with the exception of a few kinds, which are single unless earlier buds are secured. Many varieties that develop to the highest degree on the Atlantic and Pacific coasts from early August buds refuse to expand properly under more arid conditions.

As soon as the new varieties are brought under our care we make a record of the date of disbudding, selecting a few of the earliest, and repeating this operation as far as possible every five days, up to the middle of September. When the flowers are cut we make a



FIG. 11 CROWNS AS THEY APPEAR ON THE PLANT.



FIG 12. CROWN WHEN RESERVED.

record of best dates, and the next year we are in a fair position to know

just what course to follow. These records are made on tree labels and attached to the plant.

Taking the Buds—Taking the buds is an old and obscure term which simply means selecting the best and removing all others. There are two forms of buds: Crown and Terminal. The Crown is formed first and if removed the lateral growths which surround it will make buds later. The Terminal bud is the termination of the final growth and must be retained as there are no buds to follow. They have also been termed as follows: A Crown bud is surrounded by vegetative shoots and not by other buds. A Terminal bud is surrounded by other buds and not by vegetative shoots. hard, thus checking the growth without impairing the quality of the flowers.

On plants that have been planted early the crown buds often become apparent early in August. See Fig. 12. If these are removed the adjacent vegetative growths push forward and will set another bud which is generally a crown and often termed "second crown," late in August or 1st of September; much depending upon climatic conditions and treatment of the plant. If this bud is removed the lateral growths will push forward, and in the course of a few weeks develop a cluster of buds which are terminal or final, as this completes the plant's growth. See Fig. 13.

The chief merits of the crown buds are size and multiplication of petals. Many of the foreign varieties, particularly those raised in England, are worthless from late buds, producing flowers with open centers, and in many cases so much so that they could be classified as single.

The tendency of crown buds is towards loss in color and foliage. Varieties that produce pink or red flowers from terminal buds are inclined to be white or bronze from crowns.

Long, bare stems are due to selection of early crown buds. This defect can be reduced to some extent by firming the soil until it is very hard, thus checking the growth without impairing the quality of the flowers.

It has been suggested that the term "single bud" be applied to the one known as crown and "cluster bud" to the one known as terminal. We can see no objection to using these terms and thus may be able to convey our ideas to the amateur more clearly.



FIG. 13. LATERAL RETAINED FOR LATER BUD.

Fig. 11 shows the crown bud as they appear on the plant with the lateral growths. If we decide to save the crown bud, remove all laterals so it will appear like Fig. 12, and if a lateral bud is preferred remove the crown and all laterals but one, as shown in Fig. 13. The lateral retained will give a bud later. It may be a second crown or terminal, depending largely upon the date of this operation.

After the lateral growths are removed, the energy of the plant will be directed to the bud which begins to expand. Should the buds appear a few days too early, remove the laterals gradually, day by day, completing the operation on the best date. In this way the buds may be held in check without injury; although would not advise retarding them longer than eight or ten days.



FIG. 14. TERMINALS AS THEY APPEAR.



FIG. 15. TERMINAL AFTER BEING DISBUDDING.

When terminal (Cluster bud) is desired remove the crown, allowing one of the lateral growths which surround it to remain. In the course of a few weeks this growth will have attained some length and show a cluster of buds. When well advanced it will be noticed that there is one at the apex of the stem and one at each of the leaf axils, as shown in Fig. 14.

If the center or apex bud appears perfect, retain it by removing all others with the thumb and finger. This operation is termed "disbudding" and should be done as soon as buds are of sufficient size to do the work without injuring the one retained. Should the center one be imperfect or injured from any cause, save the next best. See Fig. 15.

The whole subject of buds resolves itself into a few simple facts which each grower must take into consideration before taking any decisive steps, viz.: climatic conditions, date of the exhibition, classes in which they are to compete, and peculiarities of the varieties under consideration.

The operation of disbudding should be confined to the early hours of the day as far as possible, at which time the growth is more brittle and can be easily removed with thumb and finger. As soon as the buds are



FIG. 16. SHOWING THE EFFECT OF EARLY AND LATE BUDS UPON THE FORM AND COLOR.

formed, lateral growth from the leaf axils push forward. These should be removed as fast as they appear, or the bud will be robbed of its nourishment which has been previously provided.

Stopping—Most of the exhibition growers of England have given considerable thought to what they term "timing" the buds, that is, having the flowers in perfection at a certain date. To this end they resort to stopping many varieties. The object is to force flowers at an earlier date than they would naturally mature if allowed to make a natural break. This system has not been practiced in this country to any great extent, although it may be worthy of consideration as competition grows keener.

Record of Operations—In a work where there are so many conditions which have influence upon the result, it is very important that each operator keep a fairly complete record of quantity and quality of fertilizers, and when applied, height of plants at maturity, date of bud, and general comments as to merit. Such records are invaluable for future reference.

Such details as watering, spraying, airing and shading are fully defined in the chapter devoted to commercial flowers.

Feeding—This operation is also fully treated in the preceding chap-

ter. It is impossible to give explicit directions as all depends upon the condition under which the plants are grown and for this reason it is difficult to impart this knowledge to others with any degree of accuracy.

The chrysanthemum, unlike most plants grown under glass, has its season of growth and its season of flowering, hence our object is to produce good, healthy growth and concentrate all energies to the development of the flower. Some varieties will stand much more food than others and profit thereby. To reach the acme with all varieties, the grower must be familiar with the special requirements of each, knowing when to stop feeding his variety and increase the application upon another.

It is but a step from success to failure, and so it is in these days of close competition, the expert wins out in one class and his opponent defeats him in the next; each having brought their exhibits to the highest degree of perfection in one case, and a trifle faulty in the other.



FIG. 17. BUD PROPERLY EXPANDING.



FIG. 18. BUDS DISTORTED FROM EXCESSIVE FOOD.

Feeding is generally continued until the buds begin to burst and show color, and some growers do not discontinue until the flowers are half developed. But if such a course is followed we would advise diluting the application to one-half the strength used when the plants are in an active growing state. We must remember that after buds are formed, the growth, so far as the plant is concerned, is at an end, and whatever

we apply in the way of food is immediately taken to the parts which are now being constructed, namely the petals.

At this stage of development the foliage on healthy plants will be dark green and glossy, which is due to the high living, but is not indicative of excessive feed; unless the leaves are curling badly and very important detail can only be gained by the closest observation, learning to know the need by appearance of the growth.

It is no great credit to stage a winning dozen if hundreds have been ruined to secure this "survival of the fittest," it is high average that denotes accomplishment in this art.

Pot System—Growing to maturity in pots has some advantages especially with respect to feeding as the roots are more closely confined, each



FIG. 19. BUDS BLASTED BY THE USE OF TOO STRONG FERTILIZERS.

brittle. Under such conditions caution is advisable. The mastery of this variety can be treated as to its specific needs and again the small quality of earth to which the roots are restricted permits of more frequent application of liquid fertilizers.

As soon as the plants in small pots need shifting it should be given immediate attention and with each shift a soil of a coarser nature should be used. Such material is usually available when plenty of sod compost is at hand.

The shifting continues until the flowering size is reached, which are generally 8" in diameter. When the cuttings are struck in February this final potting takes place early in June and liberal drainage should be provided by the use of broken pots and fibrous parts of sod. Tamping it very firm with a blunt stick. As soon as they reach the flowering size they are placed about 12 inches apart each way on the benches that have previously had an inch covering of coal ashes or sand to assist in retaining moisture. After providing a system for tying, the same details as given in the bench system will be adequate if given close and constant attention.

CHAPTER IX.

BLOOMS GROWN OUT-OF-DOORS*

It is not to be presumed that success can be achieved in exhibition blooms grown out-of-doors, where very cold weather creeps into the lap of Autumn, or severe frosts and freezing weather may be expected during the month of November; therefore, it should hardly be attempted in other than the southern states. The best location in the garden for this purpose should be one protected as much as possible from storms, blowing rains and winds, and all the better if a spot 30 to 40 feet square can be selected, and a 6-foot close-board fence built all around.

It is a mistake to set out plants for this purpose earlier than May, and even as late as June, although many growers are in the habit of commencing earlier. The results they have at blooming time are great tall plants, inclined to be spindling and not of that sturdy, stocky nature which invariably produces the better blooms. Besides they have worked a month or more at their plants that is wholly unnecessary.

Soil should be of a stiff rather than loamy character, liberally fertilized with manure from the cow lot, which will make it sufficiently rich and porous for a beginning. Beds should be parallel, three feet wide, with two-foot walks between and raised six inches, that drainage may be had at all times. It is well to box in the beds with boards six inches wide, and use a few inches of gravel for the walks between the beds. Two rows of plants 12 inches apart in the rows are proper distances for setting out in the beds. Get them straight and uniform, and have a few surplus plants in case any should die or fail to start off properly, that the rank and file may be in no instance broken.

Do not use too many varieties, and have at least a row of each kind, selecting those in preference that have been prize takers at the principal flower shows. A plant will make three exhibition blooms of as good quality if well fertilized as it will one, so after pinching off the end when the plant is 12 inches high, allow but three well-selected limbs to grow, and no more during the entire life of the plant, with the object of one bloom to the limb, or three to each plant. The best means of staking and tying is the wire fence method. Place stout stakes as tall as the plants will grow, eight or ten feet apart in the row, stretch wire, fence-fashion, to which the plants are tied and repeat this operation as often as required.

Never allow the beds to become dry, but water and spray the plants each day after sundown, and during August sprinkle with bone-meal

*S. J. Mitchell, Houston, Texas, who has devoted much time and attention to the chrysanthemum, particularly the subject of exhibiting and judging, has kindly supplied the foregoing article.

around the roots of the plants and give a two-inch top dressing of well-rotted manure from the cow lot. The idea should be to cause the roots to grow laterally rather than downward, hence a great depth in the beds is unnecessary.

Liquid fertilizers made about the strength of weak tea from hen, sheep and cow manure is best, and will contain all the chemical ingredients that the plants will require. This liquid fertilizing should commence about September 1st, and 10 days later the first setting of flowering buds will appear.

When buds show color stop all fertilizing and give soft water. A covering of canvas laid on sloping rafters should be given the beds to protect the opening blooms from rain or dust, in fact not a drop of water should be allowed to come in contact with a bloom at any time, and great care should be used in spraying.

Disbudding will have to be closely attended to, allowing but one (the most promising) to each limb, and usually the terminal bud is chosen for best results. The crown or early center bud is best for some varieties, but experience will have to be the teacher. Watch for insects closely; caterpillars, aphids, mealy bugs and corythuca that huddle on the under side of the leaves. Keep on the lookout for these enemies, and at the first indication apply tobacco tea or strong soapsuds to prevent their getting a strong foothold.

Do not expect blooms grown out-of-doors to be quite as nice as those with greenhouse protection, where these elements can be more surely controlled. The grower should never attempt exhibition blooms of any character if he is not prepared to devote time each day to them, and under no circumstances allow the slightest procrastination or neglect. The plants in time will repay most handsomely.

Australian Method—The conditions in the southern states are similar to those of Australia, admitting of the flowering of chrysanthemums out-of-doors. Thinking that the methods employed there may be of service to southern growers we give the following suggestions by G. Brunning & Sons, Australia: It should be taken into consideration that their spring is our fall; so that where the month is specified we should add six months. This would make September, March, or the proper time to begin propagation. And again, where it refers to the buds appearing in February, we should substitute August.

"Stand the old plants of the previous season in some open, airy position to break. From these suitable cuttings of about three inches in length are taken in September (March). After removal of some of the lower leaves the cuttings are inserted singly in two or three-inch pots filled with light, open soil and plunged in sand in a close glass frame. The only attention required until they are rooted being an occasional watering or sprinkling and ventilation for an hour or two in the morning.

"When the plants are fairly established and hardened off, repot into 5-inch pots, using a good open soil and well-drained pots. The soil need not be too rich as only a moderate growth is desirable at the present

stage. Pinch out the leading shoot at this time, thus causing the side buds to break and furnish the necessary leading growth. The plants are plunged in sand in an open sunny position and progress rapidly, so that by the second week in November (May) they are ready for 7-inch pots, when a little richer soil than previously used can be substituted, in which they may remain until the first week in January, (July).

"Now, instead of removing them into larger pots, break a good sized hole in the bottom of the pot in which they now are and plunge to the rim in a well-drained and sheltered bed, placing some good prepared soil



FIG. 20. SHELTER OF SNUG HARBOR.

under them, (such as a mixture of heavy loam, peat, sand and manure), say in the following proportions: $\frac{1}{4}$ heavy loam, $\frac{1}{4}$ peat, $\frac{1}{4}$ sand and $\frac{1}{4}$ horse droppings; add some crushed bones, wood ashes and a little soot. Should heavy loam not be procurable clay may be used as a substitute.

"By this method an opportunity is afforded them with liquid manure much easier and often than could be done if planted out in the open ground, and the plants will not attain such a height, provided they are firmly potted when shifted into the 7-inch pots.

"The only liquid manure we would advocate is made by filling a small bag with about 28 lbs. of fresh cow dung, adding a little soot (about 4-inch pot full) placing same in a tub containing 20 gallons of water, leaving it to stand three or four days before using. Dilute $\frac{1}{2}$ pint of this mixture to 2 gallons of water. Renew this preparation every two or three weeks. This manure may be given from the second week in January (July), not oftener than once a week till the buds are taken, as over-

manuring has a tendency toward promoting blind buds and in their later stages causing blooms to damp."

Shelter or Snug Harbor—At the approach of cool nights protection will be necessary where the flowers are to be perfected out-of-doors. The plan generally adopted is to build a light framework upon which cloth is stretched and fastened to form a roof. For the sides a cloth curtain should be provided and fastened in such a manner that it may be rolled up from the bottom to admit air on pleasant days. If the plants are situated next to a building or tight board fence this will answer for one side of the enclosure to which the framework may be attached. See fig. 20.



CHAPTER X.

INSECTS

Aphis—The black and green aphid infest chrysanthemums in all stages of their development and are very persistent in their depredations.

The best remedy for the amateur who grow their plants out-of-doors is to apply one of the several forms of tobacco extract, such as Nicofume, To-Bak-Ine, etc., which can be purchased of any of the large supply houses in quantities to suit the need with directions for its use. This is diluted and applied with a spray pump. Hammond's Thrip Juice No. 2, recommended for Thrip, will keep the plants very clean and is applied the same way.

Tobacco dust is often useful when only a few plants are effected, and is applied dry after the foliage has been wet so it will adhere.



FIG. 21. CHRYSANTHEMUM SHOWING GALLS.

Those who devote a considerable area to chrysanthemums under glass will find an easier way to eradicate aphid is by the use of tobacco stems as a fumigant or by using Hydrocyanic Acid Gas.

If tobacco stems are used it is necessary to dampen them a few hours ahead so they will burn slowly and prevent blazing, which generates heat and gas that often burns the foliage. Some prefer tobacco dust or a manufactured article called Tobacco Punk, which is strips of paper saturated with nicotine. Both of these burn slowly and are very satisfactory.

In fumigating with tobacco there is less danger of burning the tender tips if the foliage is wet and with Cyanide it should be dry, so avoid spraying late in the day it is to be used.

Chrysanthemum Midge—The chrysanthemum midge, or gall fly, as known among entomologists, is *Diarthronomya hypogaea* H. Lw. It was

reported in Europe as infesting several species of *Chrysanthemums*, and it appeared in this country on our establishment. In August, 1914, one of the employees called the writer's attention to a few peculiar blisters or swellings upon leaves of the new variety, *Mistletoe*, which had been purchased the preceding spring.

Having had no previous experience with other species of gall fly, it was not considered of great importance.

The following February many other varieties showed this infection and in some cases to such an extent as to render the young growth unfit for propagating purposes.

We now began to realize how serious the conditions, and if means of control were unavailable the *Chrysanthemum* industry would soon be destroyed. In March samples of infested plants were sent to Michigan Agricultural College and very soon Prof. E. H. Pettit arrived, making thorough examination, pronouncing it a species of gall fly. At his instigation samples were submitted to Dr. E. P. Felt, State Entomologist for the University of New York, who, by the end of March, identified it as the European species given above.

Since then the several Federal and State institutions interested in such subjects have devoted considerable time to further investigations.

Thus ends the American history up to the present, but unfortunately the midge still endures and probably will continue to be a menace to a greater or less degree, depending upon how thorough and vigilant the growers of this country are in the applications of the various remedies recommended.

Doubtless it has come upon us through importation of stock. In the adult stage it is a minute fly 1.75 milometers (about one-twelfth of an inch long), and in this stage deposits its eggs which in a few days begin development showing slight swellings or galls.

By opening these galls we find a yellow colored maggot, which, in the course of time, develops to the fly and so multiplication is continued.

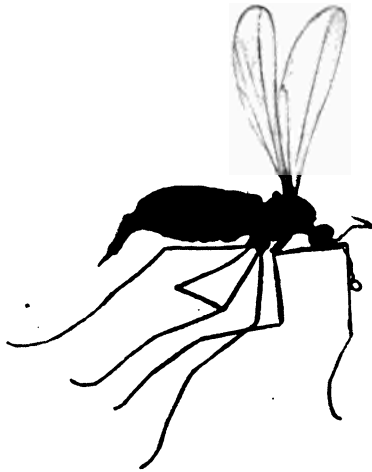


FIG. 22. ADULT FEMALE, ENLARGED. NATURAL SIZE ABOUT $\frac{1}{12}$ INCH.

Courtesy of Bureau of Entomology, U. S. Department of Agriculture.

They deposit eggs in all parts of the plant where the growth is young and tender; upon the leaf and leaf stems, the stem of the plant, the buds and even on the subterranean shoots or root stalks, provided, of course, these are exposed to the air. Their molestations are confined to the Chrysanthemum family, including the section which Florists are most interested in, as well as the garden kinds. In aggravated cases they become very numerous, stems and foliage are literally covered with these little galls, which intercepts the natural development. They become stunted and distorted and if allowed to go unchecked they will produce few if any cuttings for propagation.

While hand picking the affected leaves and stems and burning the refuse will be helpful in cases where there are so few as to give slight concern, it cannot be considered a complete remedy. The surest and best method is to fumigate either with some form of nicotine (tobacco) or Hydro-cyanic acid gas, thus destroying the fly before it has deposited eggs.

Either these agencies, used the same as recommended for Aphis, on page 42, will be effective

From the most eminent entomologists we learn the life cycle of this insect; as near as can be determined is from 20 to 30 days,—that is from the time the egg is laid until the adult is developed and ready to repeat the operation.

Here we wish to impress upon the reader that while thirty days may cover the life cycle, this period is not of sufficient duration to give assurance of clean stock even though continuous fumigations have been maintained. Our experience teaches us that where the stock plants are kept at a temperature below 50 degrees the development is very much retarded, and where freezing point is maintained the state of hibernation may be continued for several weeks, so that frequent examinations of the plants and the cuttings taken therefrom should be continually resorted to.

If the foregoing is true, the life cycle depends upon conditions during the stage of incubation and should be fully considered before there is any abatement in the process of elimination. When we consider that the female is capable of laying a hundred or more eggs, it is evidence of the importance to keep a close watch the year around for the slightest manifestations, and all employees should be instructed to report their presence when detected.

Why we wish to emphasize the importance of not discontinuing fumigations to soon, we beg to call attention to the fact that in 1918 we were convinced our stock was entirely free from this pest, but upon transferring the old plants to new quarters we still found approximately a half dozen which showed a few galls. This leads us to believe that fumigations at least twice a week should be continued throughout the summer months.

At the return of longer days, more sunlight and higher temperature under glass, the more rapid the development, both in the transformation of the larva and the activities of the females, a similar period exists as

the sun retards through September and October. During these eras nightly fumigations, or at least every other night, should be continued to keep them under control.

It has been determined the fly emerges from the gall after midnight and doubtless fumigations between that time and morning would be most effective. We have been able to keep well under control by fumigation at 6 p. m. every night, using Tobacco paper and Cyanide alternately. In using Tobacco paper occasionally the thrips, which are a serious Chrysanthemum pest when they get a foothold, are easily subdued.

Recent investigations have demonstrated that spraying the plants with nicotine sulphate 40% one part to five hundred parts of water, with the addition of one ounce to the gallon of Fish-oil Soap, will kill the emerging adults and a large percentage of the eggs, but the operation should be repeated four or five days. This method may be very useful where a small number of plants are grown and possibly be less expensive, but in larger establishments where there is considerable space to be treated, fumigation is undoubtedly the most practical owing to the saving in labor and the probability that infested parts might not be reached by the spray. It may also be very useful in localities where Chrysanthemums are grown out of doors.

To the Chrysanthemum grower the serious part of this question is the improbability of ever being entirely free of this intruder. No one is immune as long as new stock is purchased and it behooves every one interested in this class of plants to do their part in an endeavor to keep them under control. We occasionally buy plants that are apparently clean, but on the other hand a greater part are more or less affected.

We prefer Cyanide to tobacco fumigation, being more powerful and lasting in its effect. There are two forms of Cyanide, the potassium and the sodium, both are deadly poison, either in the crystal or liquid form, as well as the gas emitted when brought in contact with sulphuric acid. The highest grades of Cyanide are the best for this purpose and as 100 parts of Sodium Cyanide are as efficient as 129 parts of Potassium Cyanide, we prefer the former. Since the publication of third edition Sodium Cyanide has been placed upon the market in form of an egg—is known as Cyanegg—and these pieces do not vary far from 1 oz. each. When purchased in this form it eliminates the necessity of weighing out the amount for each jar.

The quantity used is based upon the cubic contents of the house, which is practically 1 oz. to each 6,000 cubic feet. A house 30x100 feet with average height of 8 feet will contain 24,000 cubic feet of space.

For such a house we use four small stone jars and prefer such as hold only 8 to 10 ounces (dishes used for baking beans, known as individual bean dishes, are very serviceable) rather than larger ones, as they are easier handled and more convenient.

Use a stone jar of sufficient capacity to fill the necessary number of jars and figure 3 ounces of acid solution to the jar. To prepare this solution put 5 parts of water in the jar and add 2 parts of commercial sulphuric

acid then stir well with a wooden paddle—never use any metallic dishes as the acid soon destroys them.

An ordinary tea cup with a handle is very serviceable in filling the small jars—and, as previously stated, 3 ounces to the jar is sufficient to ferment and decompose the Cyanegg.

When the jars have received sufficient amount of acid solution place them on the walks at as nearly equal intervals as possible so that the gas will reach all parts of the house. The ventilators and other outside openings are closed, so all is in readiness. Place the required number of Cyanegg in a paste-board or wooden box (cigar box if handy), and, beginning at the end of the house farthest from the door or exit, drop the Cyanegg into the jar passing rapidly to the next and so continue until all are accounted for and out of the house locking the door.

In large houses or ranges where there is a considerable space to be gassed it often requires the services of two or even more to drop the Cyanegg. The course to be traversed must be considered before hand so that each person can reach free air and safety at about the same time and thus avoid the gas fumes.

Those who have not used the deadly poison should be very careful both in handling it and after it has come in contact with the acid. The gas is as transparent and colorless as the air, but when inhaled it is death to all animal life. Never undertake to investigate its action or re-enter the house for three hours after its installation. Also see that the houses are locked to protect persons who are unaware of the danger.

Red Spiders—The most difficult insect we have to contend with under glass is the red spider, which is very minute, scarcely discernable by the naked eye, but if allowed to go unchecked will become very numerous, forming a fine web about the leaves and buds. It is generally first detected on the underside of the leaves where they are not dislodged by spraying. Dry, hot air is most congenial to their welfare and after these conditions have been brought about by turning on heat, houses have been ruined which were apparently clean and gave great promise early in the season.

The best remedy known is water, which should be applied in the form of a spray with as much force as possible to destroy the web and dislodge them. It is important that it be applied to the under as well as the upper side of the foliage. Thorough and repeated applications are the only source of relief.

Thrips—These, like the foregoing, are very small, the adults being scarcely a 1-16 of an inch in length, of a grayish white and very slender or hair like, in fact they look very much like clippings of white or gray hair. Their presence is first indicated by slightly brown discoloration between the midribs on the under side of leaves and when allowed to go unchecked the whole undersurface will have a decided brown cast, eventually extending to all parts of the plant including the buds and blooms. Spraying with considerable force will dislodge them to some extent.

The best remedy we know of is Tobacco fumigation where the plants are grown under glass or wherever the fumes can be confined and is used

the same as for *Aphis*, but often requires several fumigations to expedite and accomplish the purpose.

When plants grown out-of-doors become infested it will necessitate using either some form of Tobacco extract applied with a spray pump 1 to 2 teaspoonsful to a gallon of water or Hammond's Thrip Juice No. 2, at the rate of 1 part to 40 parts of water used in the same manner.

Leaf Tyer. (*Phlycaenia ferrugalis*). From Fig. 21 it will be seen there are three stages or forms of life during its existence. The first is the larvae or worm, which is light green and feeds usually upon the underside of the leaves, leaving the epidermis or skin like upper surface. Its habit of drawing two large leaves together or rolling the edge under by means of a fine silky web is whence it derives its common name leaf tyer. As the worm attains full size, about $\frac{1}{2}$ inch long, it seeks a secluded place where it changes to the second stage or chrysolis form and is about $\frac{3}{8}$ -inch long with a brown covering. In a few days this chrysolis breaks



FIG. 23. LEAF TYER, SHOWING THE LARVAE, CHRYSOLIS AND MOTH STAGES.

its covering and in this transformation is provided with wings, then being in the third or mature moth state. With these wings it is enabled to go to other plants or houses and deposit eggs which soon become larvae. Such remedies as paris green, arsenate of lead are effective if it were, possible to apply to the underside of the leaves, but we find such applications are not sufficiently vigorous in their action to keep them in check. Tobacco and cyanide fumes have no effect.

When stock plants are badly infested we find it advantageous to remove every green or growing shoot and leaf before replanting then for propagating purposes.

Should such a course fail to eliminate the trouble, dip the young plants before planting into a strong solution of arsenate of lead (the dry form is best), say 1 oz. to a gallon of water, and thus poison the larvae.

Another method is to plant sufficient stock for propagation out of doors and allow it to remain until after heavy frosts (October 15th) before lifting and housing thus assuring clean stock plants provided all infested plants are destroyed.

Mealy Bug—As commonly known it is a white, mealy, downy looking insect. Generally it does not infest chrysanthemums to any extent, but we have seen cases where they were more or less troublesome. If not very numerous they may be hand-picked. When this is impractical, alcohol

diluted one-half and applied with a brush or atomizer will destroy them without injuring the foliage.

Grasshoppers are sometimes troublesome, devouring the tender leaves and stems, and the best remedy is hand-picking, which should be done as early in the morning as convenient, when they are more docile and easily caught. Should they be very abundant, an application of Paris Green may be given. Care should be taken not to apply too freely or it will burn the foliage.

A safe rule is 1 part Paris Green to 150 parts air slacked lime which should be thoroughly mixed.

Tarnished Plant Bug (*Lygus Pratensis*) is a great hindrance and often causes total failure to plants grown in the open border. See Fig. 24. They are brought into the greenhouse on various plants, like carnations and geraniums, and immediately find a favorable feeding ground upon the chrysanthemum. This destructive bug procures its food by thrusting its proboscis into the tender growths, ex-



FIG. 24. TARNISHED
PLANT BUG.



FIG. 25. DEPREDACTIONS OF THE TARNISHED PLANT BUG.
BRANCH SHOWING MASS OF BLIND GROWTH.

tracting the sap, thus causing the tips to flag, which may be considered evidence of their presence. In the young state they are of a yellowish green color and seem to confine their depredations to the apex of the stem and soon destroy the center.

As soon as the lateral growths push forward they take to these, and thus the operation is repeated until the plant often becomes a mass of stunted growth. See Fig. 25.

The adults are yellowish brown, about 3-16 of an inch in length, and will continue their destructive work upon any part of the plant or flower that is soft and abundant with sap. They puncture with such violence as to distort the growth and ruin promising buds, and later on deface the petals of expanding flowers. The pest is known in nearly all parts of the United States, being more or less destructive to many other plants, such as asters, goldenrod and sunflowers, and they are very partial to carnation blooms.

Hand-picking is the best remedy we have found, and whoever attempts to catch any of these little intruders must be alert indeed. The adults will fly at the first intimation of your presence and the young either hide under the leaves or drop to the lower part of the plant.

Corythuca Gossypi is about the size of a full grown aphid; color, a dirty gray, having a woolly appearance. It is more or less troublesome throughout southern states, but is little known in the north, although it has been reported in many localities. Its habit is similar to the red spider feeding upon the under side of the foliage. It is reported as being very destructive, and the affected leaves curl and die. When disturbed they fly to the ground and immediately return to the plants by climbing up the stems and are soon re-established. The best remedy is weak kerosene emulsion, and this should be applied to the under side of the leaves to be most effective.

Grub Worm—The common white grub so prevalent in meadows is often carted into the house with the soil. The first indication of their presence is, the plant will begin to wilt and eventually die. They harbor in the soil and feed upon the roots and should be hunted out and killed.

Cut Worm—This dark-colored worm, which sometimes attains two inches in length, burrows in the ground and at night feeds upon the foliage of the plants, generally going to the tender leaves at the top. Owing to their nocturnal habits they are easier caught at night.

Lady Bird (Coccinella).—This little beetle varies in size and color, being from $\frac{1}{4}$ to $\frac{3}{4}$ of an inch in length in the adult form and nearly round. Commonly red with black spots, varying in size and number.

In the larvae state they are $\frac{1}{2}$ inch long, color, bluish-gray, more or less marked with yellow and black spots. At a certain stage of development they fasten themselves to the under side of the leaves and in a day or so shed their larvae coat and are thus transformed to the winged or mature state. In all stages they feed upon the aphid but are more active and greedy when young. They are also known in this country as lady bug and should never be molested, as their persistent hostility to the aphid is very beneficial.

Lace-Winged Fly or Goldeneye (Crysopa Oculata).—This fly which in the mature state, is a peculiar shade of light green, approaching opalescent tints, entirely except its golden eyes. It is about one inch in length and its

large wings are reticulated with a network of ribs to strengthen the thin and transparent tissues. This lace-like reticulation is the source of its common name "lace wing." The larvae is one-half inch long and nearly or quite black in color.

In the larvae state it will be seen traversing the young shoots and leaves where the aphids are usually most abundant. When within reach it seizes its prey with two horny, jaw-like appendages to hold it secure and then thrusts its proboscis, or bill, into the aphid body extracting the juice



FIG. 26. LACE-WINGED FLY. SHOWING LARVAE AND MATURE STAGES.

the same as the mosquito operates, when the lifeless shell is released and the larva proceeds to its next victim.

Chrysanthemum Fly—This insect closely resembles our honey-bee, although a trifle larger. When on the wing it makes a similar humming sound but can be handled with impunity, as it cannot sting. It makes its appearance with the first chrysanthemum flowers and disappears at the close of the flowering season.

It cannot be considered a foe or friend, its sole object being to gather bee-bread from the more single flowers. It has been used for the purpose of raising seed, being an excellent agent in fertilizing flowers, as it continually roams from one flower to another. Seed thus obtained cannot be considered very valuable, inasmuch as they never visit flowers that are fully double and the results thus obtained would be degenerative rather than progressive.

CHAPTER XI.

DISEASES

Rust is not so prevalent in this country as in England from the fact our atmosphere is dryer. It makes itself apparent with the approach of cool nights and is generally augmented by excessive moisture.

H. J. Jones, Lewisham, England, describes this fungus in the following comprehensive manner. "It appears the fungus originates in the tissue of the leaf, and is mostly confined to the under side, although there are many instances in which pustules appear on the upper surface of the leaf. A pustule, simply described, is a little pimple which bursts, exposing a dark brown dust, at maturity. This brown dust is none other than liberated spores which drop out of the pustule, and fall on, or come into contact with the chrysanthemum foliage, and when this is in a moist condition it quickly grows and very speedily develops a germ tube which very soon finds its way into the tissue of the leaf, and after a time repeats itself.

"There are many remedies given, such as bordeaux mixture, and ammonical solution, as well as other prepared compounds. These, doubtless, are more or less effective, but we can hardly expect a permanent cure from their use unless we maintain conditions that are unfavorable to the development of new spores."

A few years ago the carnation rust which grows and reproduces itself in the same manner, and as far as we know is identical, caused great anxiety among carnationists, who feared its prevalence would gain such a foothold as to be ruinous. Experience has taught them to remove the cause or conditions under which it develops rapidly. To this end they house the plants early, spray only on bright mornings and maintain a dry and buoyant atmosphere as far as possible.

If chrysanthemum growers will take the same precautions there is little fear of the disease becoming wide-spread, or doing great damage. Over-crowding the plants so that the foliage does dry off quickly, indiscriminate spraying, particularly when applied late in the day in the autumn months, and lack of air should be strongly guarded against.

In aggravated cases it would be well to try the following remedy, given by W. Wells, Redhill, England, in his new work just issued, "The Culture of the Chrysanthemum."

"Spray every cutting or plant once a fortnight—from the day the cuttings are inserted or the old plants are cut down with about a wineglass full of paraffine (kerosene) mixed with one gallon of water, using an Abol syringe with the spray nozzle. If the solution can be kept thoroughly mixed, double the strength may be employed. Then from July 1st spray the under part of the foliage with a dressing composed of the following ingredients: half-pound each of sulphur, soft soap, soot, and lime. The lot should be boiled for half an hour in one gallon of water; a half pint

of paraffine should then be added and the mixture allowed to simmer for a minute, or so, care being taken to prevent it from-boiling over. The dressing should be allowed to stand until it gets clear, and may be kept in bottles. A quarter of a pint of the dressing may be used to a gallon of water. If, however, the fungus is very bad and has obtained a hold on the plant, double strength can be used without injuring the chrysanthemum."

Leaf Spot—With this fungus (*Septoria Chrysanthemi* E and D) the spore bearing cavities are imbedded in the leaf tissue, and as they mature the spores ooze out of these cavities and thus spread the disease. They may be killed by applying Bordeaux mixture or some similar fungicide. Another fungus disease which often attacks the chrysanthemum is known as *Clyndrosporium Chrysanthemi*. It is a more rapid grower than the *Septoria* and the plants affected by it are often so stricken down as to be unable to make any blooms.

The leaves of the affected plants begin to roll up, the outer edges turning under and this condition becomes so apparent that even the inexperienced grower will know at a glance that something is wrong. Some varieties seem to be strong enough to withstand this fungus, hence in nearly every case where the writer has known its presence it has confined itself to certain varieties and very often those growing adjacent were not affected in the least.

The best remedies are Bordeaux and ammonium mixtures.

The foregoing is an abridged article on leaf spot by Prof. . Byron D. Halstead appearing in *American Chrysanthemum Annual*.

Bordeaux Mixture.

Copper sulphate	6 pounds
Quicklime	4 pounds
Water	40 gallons

Dissolve the copper sulphate by putting it in a bag of coarse cloth and hanging this in a vessel holding at least four gallons, so that it is just covered by the water. Use an earthen or wooden vessel. Slake the lime in an equal amount of water. Then mix the two and add enough water to make 40 gallons. It is then ready for immediate use.

Ammoniacal Copper Carbonate.

Copper carbonate	1 oz.
Ammonia	enough to dissolve the copper
Water	9 gallons

The copper carbonate is best dissolved in large bottles where it will keep indefinitely, and it should be diluted with water as required.

Mildew—A common name applied to several forms of microscopic fungi. The one affecting the chrysanthemum is white and forms a coat over the leaves and tender shoots and is caused by a sudden check of some nature.

Sulphur in some form is the accepted remedy, being applied as dust directly to the leaves, or by mixing equal parts of sulphur and air slacked

lime, adding water until the consistency of paste and painting the steam pipes. The formula given by W. Wells for rust is recommended for mildew and doubtless is effective.

Potassium Sulphide is also highly recommended for mildew and rust, applied to the affected parts at the rate of one oz. to two gallons of water.

Many of the private gardeners consider a preparation known as grape dust an excellent preventative for mildew and other fungus diseases which is applied with a bellows or some other air blowing device.

CHAPTER XII.

SEEDLINGS AND SPORTS

Before entering the details of this subject let us consider some of the natural conditions which have more or less influence upon our results. Dame nature says the chrysanthemum shall be single and reproduce itself from seed, so in producing these marvelous flowers with almost countless petals we are working in direct opposition to her laws.

In some of our improved varieties we are prevented from making further improvements owing to the pistils or styles being abortive; and in others the staminate florets provide little or no pollen.

In cross-fertilization the operator's desire is to improve the chief characteristics, such as color, size, form and fullness. It is beyond all human power to obtain exact results in uniting or mixing the colors of petals. Pollen of a white flower applied to a red may give red, white, or any intermediate shades which would be many varieties of pink. The union of red and yellow gives similar results, producing red, yellow and all the intermediate shades of brown and tan. We have more assurance when varieties of the same colors are crossed. Improvements in colors can only be attained by bearing in mind the laws of nature in making these unions.

The chrysanthemum has a great tendency to revert to its antecedents. Hence it is we get many strangers when two of the same color are crossed. The variety, Mrs. J. J. Glessner, yellow, came from Edward Hatch and Mrs. J. Jones, both white or nearly so. This seedling partook of the parentage of Ed. Hatch which was *Gloriosum*, yellow, and Ada Spaulding, pink.

Form, size and fullness are improved only by careful consideration of these qualifications in varieties at our disposal. We are more certain of advancement in the style of growth, securing those which are dwarf and sturdy by confining our operations to such as possess these qualities.

Large and small foliage can be produced by using those having these peculiarities.

What governs the potency of the pistillate and staminate parent we cannot determine. We are dealing with minute affairs. The stigma may scarcely have reached maturity when the pollen is applied, or the pollen may be past its prime with the stigma at the height of development. These varied conditions may have their influence upon establishing the character of the seedling.

In selecting varieties for this work the two classes for consideration are those for exhibition and commercial use. In the former, size is the most important factor if the other qualifications are up to the average. The commercial grower requires staple colors, and the purer the color the better. Size, form, fullness and style of growth are important and should be taken into consideration.

Seed Plants—Our experience leads us to believe that single stem plants in 4-inch pots grown naturally without an abundance of nourishment are best suited for this purpose. They produce less ray florets, hence

pollen is easier to gather. The styles in flowers thus treated seem to be in better condition, or at least more normal and produce seed more freely. We have arrived at these deductions by endeavoring to procure seed from those grown for exhibitions and in nearly every case our efforts have been fruitless.

Plants intended for seed raising should be staged in a dry, light house, and excessive moisture at the roots or in atmosphere should be avoided.

Fertilizing—The operation begins when the flowers are half open by cutting the petals off close to the base with a pair of scissors, until the styles are exposed. See Fig 27.

Fig. 28 represents an enlarged ray and disc floret. No. 1 is a petal which furnishes the color. This is provided with a style or pistil and when in condition or fully expanded is in proper condition to receive the pollen which is applied to the upper surface, (B) known as the stigma. The disc floret (II.) also has a style, but is provided with stamens, (C) which furnish the pollen. These should be removed from the seed plant with the points of scissors to prevent self-fertilization.

After the flower head has been trimmed select the desired flower for pollen. Push aside the ray florets or petals until the disc florets are in view. Collect the dust-like pollen on a camel's hair pencil or toothpick and apply to the stigmas of the flowers previously prepared. This completes the operation.

How fertilization takes place is fully described by Prof. Bentley in his *Manual of Botany*:

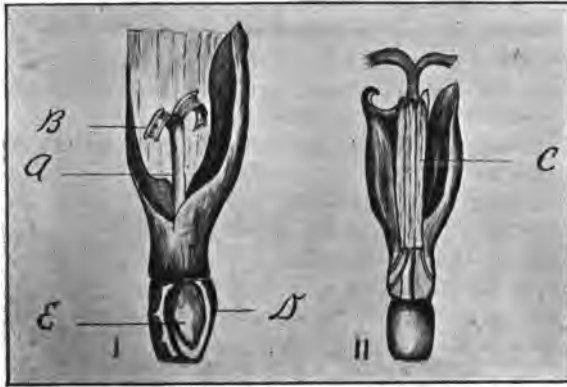
"When the pollen falls upon the stigma its intine protrudes through one or more pores of the extine in the form of a delicate tube which penetrates through the cells of the stigma, by the viscid secretions from which it is nourished. These pollen tubes continue to elongate by growth and pass down the conducting tissue of the canal of the style, and thus reach the ovary where the seed is formed."

If a toothpick is used never use it for more than one kind of pollen. By allowing the camel's hair pencil to stand in an open mouth vial of alcohol a few minutes after using, it may when dry be used upon another variety without fear of the former operation affecting the present.



FIG. 27. FLOWER TRIMMED READY FOR FERTILIZATION.

Pollenizing should be done on bright, sunny days as far as possible. In wet weather a dry, warm house can be utilized and the work continued each day, provided sufficient pollen is at hand. On bright days pollen is



(A) Style—(B) Stigma—(C) Stamens—(D) Ovary—(E) Seed

FIG. 28. I. PISTILLATE FLORET. II. STAMINATE FLORET.

generally very abundant, and may be collected, stored in vials and labeled ready for use. If kept perfectly dry this pollen will retain its vitality throughout the chrysanthemum season.

After fertilization give the plants only sufficient water to keep them from wilting. Always keep a record of the work, showing the parents of the seedlings. It will afford pleasure to know how a meritorious variety was produced, and may suggest possibilities along other lines.

Seeds ripen in five or six weeks. Those fertilized early in the season give the greatest number of seeds, doubtless due to more favorable weather at that time. Do not anticipate super-abundance of seed. The crosses which give but few seeds generally produce the best seedlings. Hand pollenized seeds are of more value than those naturally fertilized. It at least seems rational to expect more from seed secured by the union of our best kinds than from that produced by the wind without intent, or the bee whose only object is to secure his daily sustenance. If this be true, our results depend upon the degree of intelligence employed in the selection of parents, and thoroughness with which every detail is attended.

Seedlings—The seeds should be sown in light soil as soon as they are ripe, using pots, pans or shallow boxes. They should be covered lightly and kept in a temperature of about 60 degrees, until they have germinated. If kept in too high a temperature the seedlings are quite apt to damp off, and at the first indication of such a condition move to a more airy place. As soon as they have made their second pair of characteristic leaves, prick off into shallow boxes, planting about an inch apart. When showing signs of crowding they should be potted separately and repotted as often as necessary or planted into the bench, same as standard varieties.

They flower the first year from seed and there is nothing more interesting than to look over a large lot of seedlings and note the diversity of color and form. After the planted seedlings are established we nip out the top and allow two breaks to come up and flower, and as far as possible select a crown or early bud on one of these, and terminal or late bud upon the other; thus we gain some knowledge the first year as to which bud produces the best flower. Those that are considered desirable may be saved and given further trial.

Sports—The word "sport" in connection with chrysanthemums refers to varieties which originate by bud variations and are termed "sports." Occasionally a variety will sport the first or second year after its origin from seed, but generally it does not take place until several years have elapsed, and then often simultaneously in remote localities. This has occurred in this country, the most marked case being that of Mrs. J. Jones, sporting to yellow. As a rule most of the whites sport to yellow, and pinks to white, although Vivland Morel gave us a sport variety, Chas. Davis, which is bronze, and has also sported to white in the variety Mrs. Ritson. Louis Boehmer, magneta pink, sported to white and named L'Enfant des deux Mondes. This variety sported under French cultivation to yellow and is known as Leocadie Gentils. Louis Boehmer, the original variety, has given us several other sport varieties, such as Wm. Falconer, light pink; Mrs. C. B. Freeman, bronzy yellow, and Beauty of Truro, bronzy cerise. It is worthy to note that many varieties have changed their color in this way many times, while others that are now very old have never shown any inclination to sport. The yellow varieties seem less inclined to sport than other colors, possibly this is due to the fact that yellow is the original color of chrysanthemums.

Philadelphia, a light yellow, gave a sport several shades darker, and is known as Pennsylvania. It need not surprise anyone cultivating chrysanthemums to notice a plant having flowers of two distinct colors. Sometimes the sport flowers will be one-half the original color, and again possibly on the same plant another bloom will be the new color entire.

It has been reported that flowers sometimes sport in form, that is, give a flower of entirely different form from that originally possessed, such as an incurved flower sporting to a reflexed form. Such cases are at least few and far between, in fact we are inclined to disbelieve that such changes have really taken place. Cultural conditions often change the form of flowers materially, also buds selected, and doubtless some of the cases reported were simply due to these causes.

To perpetuate the new color of the plant that has sported the method generally followed is to cut the leaf on the flowering wood with a heel or portion of stem and place these under a bell glass or closed case to induce them to make root after which they send forth new growth. These are planted the next season and if any possess the original color they are discarded and those of the new color saved. Generally in the course of two or three seasons it is safe to consider the new variety established and color fixed, as it is termed.

CHAPTER XIII.

PREPARING EXHIBITS

Some time previous to the flowering season suitable boxes should be made ready. Also material necessary for packing and staging, such as cleats, excelsior, paper for wrapping and lining cases, labels for plants and cut blooms, and exhibitors' cards. This will save anxiety at the last when so many details require constant attention.

Plants—All pots should be washed clean before packing and each plant securely staked and tied, thoroughly watered, and plainly labeled. Where specimens and standards are to be exhibited, the intervening spaces between the blooms should be filled with crumpled tissue paper to prevent shifting and rubbing against each other. With a strong cord draw the plant together as close as possible without injury.

If they are to be transported a short distance and the weather is favorable they may be taken as they are. For long shipments that will be



FIG. 29. WRAPPING A BLOOM.

six or more hours in transit, provide each plant with a frame work, around which paper can be wrapped to keep the blooms clean. Should there be danger of freezing, cotton wadding or several thicknesses of paper will be necessary.

Single stemmed plants are usually shipped in boxes the height of the pots, with a post in each corner (extending a little above the plant) to which strips are nailed horizontally to form a rigid framework. The spaces between the pots are tugged with excelsior and the flowers wrapped with paper or other tissue. The frame is then covered with paper or other material as necessity demands.

Cut Flowers—Blossoms that are likely to be too far advanced for the exhibition should be cut and stored in water in a cool cellar with some light (in total darkness the foliage soon turns yellow), cutting off a small portion of the stem and giving fresh water every three days. In this way they may be kept two or three weeks in a very presentable condition.

All blossoms should be cut and stored in water at least 12 hours before packing and longer if possible. This allows them to take up sufficient water to harden the foliage and petals. In brighter weather it is best to do the cutting early in the day while they are firm.

The most suitable sized box for packing depends upon the size of the blossoms, number to be packed, and required length of stems when staged. They must be of sufficient depth so that the cover when nailed does not crush the blossoms. When large exhibits are to be handled, boxes 6 feet long, 2 feet wide, and 10 to 12 inches deep or thereabouts are the most serviceable.

The box is first lined with paper to exclude air, and if cold, enough to protect from frost. The next step is to consult the schedule, sorting out each entry so they may be packed by themselves. If no one accompanies them to attend the staging, each class should be divided with a sheet of paper and plainly marked, giving class number so that the person in charge will know each entry at a glance.

Each blossom should be labeled with a white card plainly written. A very suitable size for this purpose is $1\frac{3}{4}$ by 4 inches, which should be tied to the stem near the blossom. A few extra blossoms should be added in case some are injured in transit and the packer will have to use his judgment as to how many are required, by their present condition and apparent substance. Where the entries require a large number of blossoms it is advisable to label them, even though they are to be accompanied with someone who is conversant with unpacking and staging, as it saves much time and confusion at the last moment when it is urgent that all exhibits be in position at the allotted hour.



FIG. 30. BLOSSOM WRAPPED.

Make rolls of excelsior wrapped with paper $2\frac{1}{2}$ or 3 inches in diameter, and as long as the box is wide. Sheets of tissue paper large enough to cover the blossoms should be cut on one side to the center, and having the blossoms near at hand, all is ready. It requires two persons to pack to advantage, one placing the blossoms in the box and attending to clearing, and a helper tying on the labels and hold-

ing the blooms while being wrapped. Beginning at one end of the box place a roll of excelsior 6 or 8 inches from the end. The helper takes a bloom and holding it head down the packer slides the cut tissue paper around the stem, draws the edges downward giving the corners a few turns with the thumb and finger to keep in position. See Figs. 27 and 28.

It is difficult to say how tight the blooms should be wrapped, much depends upon their form and condition. Those of the reflexed type, like Viviland Morel and Yanariva, may be rolled moderately close without injury, while such varieties as Mrs. H. Robinson and Col. D. Appleton, should be given a little more freedom. After a little experience the packer will determine at a glance how tight.

It is then placed in the box allowing the neck of the flower to rest on the roll of excelsior, the object being to prevent outer petals being



FIG. 31. BLOOMS PROPERLY PACKED.

bruised. It is wise to select the largest blooms and those having the longest stems for the end of the box. This operation is repeated until the first row across the box is completed and the packing is continued in the same manner until the third row is finished. See Fig. 29.

One or more wet newspapers should be laid over the foliage. Over these a wooden cleat is placed, pressing the stems down firm and nailing securely from the outside of the box into the end of the cleat, so they can not shift. The cleats should be placed far enough from the blooms so the next tier will not rest upon them and thus be injured. The packing is continued until the blooms cover about one-third of the box, then begin at the other end and proceed in the same manner.

In warm weather it is advisable to well moisten the foliage, the aim being to keep the foliage wet and the blooms dry. Some prefer not to

wrap the blooms, but instead place on a sheet of tissue, bringing the ends up so as to act as a partition between the adjoining blooms, also the sides. This system of packing is along the same lines as that usually employed by the wholesale dealers in packing Roses and Carnations.

Foreign Shipments—Flowers grown in this country have been exhibited in England and vice versa. The directions given for packing are practical in such cases, but would suggest the stems being cut not to exceed 12 inches in length, and use Kift's Rubber Capped Flower Tube for each specimen. These tubes are glass vials with a tight fitting rubber cap which confines the water to the tube and thus the supply is sufficient to keep them fresh.

Another method is sometimes employed in which the flowers are packed so they stand upright, a very good system where the exhibit is not very large, or the distance to be shipped very long. The size commonly used is 3 by 4 feet and 2 ft. 6 inches in depth, but should the schedules require longer stems a deeper box will be necessary. These boxes are provided with cleats, one a few inches from the bottom and the other placed so as to come directly under the bloom. In packing put two cleats in position at one end of the box and after the blooms have been wrapped set them in position and tie securely, top and bottom.

As soon as one row is completed another set of cleats are adjusted and the work continued. The ends of the stems may be wrapped with sphagnum moss or inserted in rubber capped tubes filled with water to keep the foliage from wilting. Packed in this manner the foliage dries out more than when laid flat in the box owing to the large amount of air space, hence the necessity of providing moisture at the end of the stem to prevent flagging. These boxes are generally constructed with a hinge cover, also one side or end hinged from the middle so that the upper portion may be let down, making it more convenient in packing and unpacking.

Dressing Flowers—This is resorted to somewhat by foreign exhibitors, but little practiced in this country. In fact most schedules prohibit dressing. The Incurved section requires more attention than the Japanese when this operation is resorted to. The method is simply to remove short or deformed petals and arrange perfect ones to occupy their places, also to separate those which have grown one into the other to form a regular rounded flower when finished. Sometimes semi-incurved Japanese are dressed to give them a reflexed appearance. As far as known about the only dressing done in this country is the removal of deformed petals, which are likely to occur in any of the types. Very often strap-petals will appear in the cushion of the Anemone varieties and thus detract from their appearance, and should be removed with a pair of tweezers.

CHAPTER XIV.

STAGING

Staging Plants—In arranging plants for exhibition much depends upon the schedule, which should be thoroughly digested to conform with the rules and regulations. Then consider space allotted, and if next the wall to be viewed from one side only, the tallest plants should be put in the background and others graduated to the shortest in front.

If the exhibit contains more than one color this should be considered and arranged for best effect. Groups for the center of the hall are arranged on the same plan, but such exhibits are viewed from all sides and will require greater effort to bring out uniformity.

In France the space allotted to plants is covered with light soil, into which the pots are plunged and the earth covered with green sod. In this way they have the appearance of being permanently planted, which adds greatly to the attractiveness of the exhibit.

Staging Blooms—Collections of cut blooms are generally shown one in a vase, arranged on tables usually at the side of the hall, so there is but one congregational side. Such tables will accommodate three rows in width and after the vases or glasses are so placed the blooms are arranged so the middle row will be slightly elevated above the first and the back row above the second. The object is to have each bloom show distinctly both its size and form. The largest ones should be placed in the back row and the smallest in front. When placed in this manner they appear to be nearly all of a size. The light and dark colors should be alternated as much as possible for the best effect.

If there are restrictions as to length of stems this must be considered at the beginning, but if left to the discretion of the exhibitor ten or twelve inches for the first row will be about right, and three to six inches longer for each of the successive rows, according to the depth of the bloom.

The foregoing rule is practical where the tables are of regulation height, about 2 ft. 7 in., but if only a foot or so from the floor it will hardly be necessary to make any distinction as to length of stem, inasmuch as the exhibit will be viewed from above. When the tables are built terrace-fashion the stems may be nearly or quite the same length.

Boards—The board system so popular in England for staging collections is seldom used or little known to American exhibitors. It consists of a board 18x24 inches nailed to end pieces so that the front will be three and the back six inches above the table and are painted green. Holes are bored to accommodate twelve blooms, three rows front to back. The petals of each bloom are supported by a funnel-shaped cup terminating with a tube into which the stem is inserted and when properly adjusted a wedge is crowded between tube and stem to hold securely. The stem

and cup tube are passed through the hole in the board into a tube containing water.

At the Kansas City show of 1902, mossed banks were substituted for the typical boards. These were constructed by nailing 6-inch boards running lengthways of tables to scantling. The boards were placed far enough apart to admit the neck of a bottle and the back elevated to give a slope of about 3 inches to the foot. Bottles were placed so the top of the necks were even with the boards, at the proper distance apart to receive the blooms and the whole framework was then covered with green moss. This system is very practical where large collections are to be staged and has been adopted by many of the managements of the leading flower shows. This system enables us to display a greater number of varieties, including those with weak stems, which cannot be staged in vases to advantage.

Vases—Classes calling for more than one bloom of a kind are generally staged together and may vary in number up to 100. When three to six are required, 18 to 24 inches are considered sufficient length of stem; twenty-five to fifty, 3 to 4 feet, and vases of one hundred will need 5 feet or more for those occupying the center. In arranging vases of twenty-five or more the aim is to have each bloom show distinctly and the general appearance as symmetrical as possible.

When the schedule states "arranged for effect," colors which harmonize are considered best, such as white and pink, or yellow, bronze and red. Sometimes a few of the Anemone section may be used to advantage in such classes, giving diversity in form.

CHAPTER IV.

EXHIBITIONS

The Management—The annual exhibition requires mental and physical as well as financial support and is generally more successful when backed by a strong organization. Very few exhibitions are certain of being successful year after year, particularly from a financial standpoint. Unfavorable weather is likely to impair the attendance and some other local attraction may divert the public.

Such organizations should appoint committees to handle certain parts of the work, such as arranging and mailing a schedule, music, advertising, and as the date of the show draws near supplement committees for decorating the hall, etc. The preliminary, or, if possible, complete schedule, giving the principal classes, should be mailed in January.

Make them definite. For example: Best twenty-four blooms white, three varieties, stems not less than 36 inches, shown in one vase. Best twenty-five plants, five varieties, grown to single stem and bloom in five-inch pots, not exceeding 30 inches above pots. When so arranged the manager is not hampered with questions. The exhibitor knows just what is required, and the judge has but one thing to consider,—quality.

The larger the premium the stronger the competition. Big prizes and honor of winning same are incentives which are far-reaching and should be duly considered for sake of display. This course is a greater necessity in localities remote from the center of chrysanthemum cultivation, which is probably between Cleveland and Pittsburg.

If a final or complete premium list is issued it should appear a few weeks before the date of the show and may be arranged to serve the purpose of a program and thus curtail expense. The advertising is an important feature and the press should be furnished with short items of interest to the public that will also refer directly to the exhibition. If possible they should be supplied with photographs of intended exhibits and description of same. A month prior to the date posters and other forms of advertising will be necessary.

It is of great importance to have a competent secretary, as much depends upon accurate records of entries, premiums, etc. W. N. Rudd, Mt. Greenwood, Ill., in his able article, "The Management of the Exhibition," read before the American Carnation Society, suggests the following for the accounting department: "The writer prefers the De La Mare system of exhibition accounting, as being simple, speedy and accurate. It consists of an exhibitor's book, a class book, a judge's book, entry cards and envelopes for them, a set of gummed labels of different colors, 'first premium,' 'second premium,' etc., to be attached to entry cards by the judges as they complete each class."

The person best suited to act as superintendent or manager should be selected and have full charge of all materials pertaining to the exhibition from the first day until the hall is vacated. From the schedule and entries received he will know about how much space will be necessary for the various classes, and if wise will study the hall carefully, mapping out where each class and group shall be staged. It will also be his duty, unless left to a committee, to provide suitable tables and vases and other requisites necessary. The vases should be of suitable size to accommodate the various classes, but should be uniform in each specific class, so one exhibitor has no advantage over another. These should be filled and if possible placed ready for use, on or before the opening day to avoid confusion and delay.

Provide new features each year, as the public are constantly looking for something novel.

Pre-arrangement is an important factor to well conducted exhibitions. Details that can be arranged prior to the opening will save the manager much anxiety at the last moment, and whatever facilitates his work will assist the exhibitor and the task of judging will be less laborious.

The Judge—In selecting a judge it should be a person having sufficient experience to be fully competent, and whose honor and integrity are above reproach. One to three judges are the number generally used, sometimes in large exhibitions where there are many classes to consider, a greater number are pressed into service and divided into sets, each set being allotted certain classes. When so arranged the awards are made with the least possible delay.

The Chrysanthemum Society of America has adopted scales for judging which define the important qualifications to be considered in the various classes. They are as follows:

Scale of points for bush plants and standards.

Equality of size and form of plant.....	40
Excellence of bloom.....	35
Foliage	25
Total	100

Scale of points for plants grown to single stem and one bloom. A height of not over three feet is recommended for plants in this class, and pots not over six inches in diameter.

Excellence of bloom.....	40
Compact, sturdy growth.....	35
Foliage	25
Total	100

CUT BLOOMS
FOR COMMERCIAL PURPOSES.

Color	20
Form	15
Fulness	15
Stem	15
Foliage	15
Substance	15
Size	10
<hr/>	
Total	100

FOR EXHIBITION PURPOSES.

Color	15
Stem	5
Foliage	5
Fullness	15
Form	15
Depth	15
Size	30
<hr/>	
Total	100

SINGLE VARIETIES.

Color	40
Form	20
Substance	20
Stem and Foliage	20
<hr/>	
Total	100

Single varieties to be divided in two classes—the large flowered and the small flowered.

POMPONS.

Color	40
Form	20
Stem and Foliage	20
Fullness	20
<hr/>	
Total	100

There are many qualifications to be considered and it is not difficult to determine which exhibit is most meritorious. The color should be clear and positive, whatever it may be. There is no form which could be considered perfect for all the varying types. Each possess specimens which are ideal as far as their particular class is concerned. Blooms having the greatest depth would have preference to those that are shallow, not only in quality of form, but size. Size is easily determined and can be decided upon without great effort.

Fullness refers to the number of petals, hence those showing a disc or eye would be considered deficient in this respect.

Substance deals with the texture of the petals and those which are soft and flabby should be secondary to those possessing a firm texture.

The stems should be straight, of good length and stiff enough to properly support the bloom. The foliage should be luxuriant, of good color and well up to the bloom. It is not always necessary to use scales in judging, as often the contrast of competitive exhibits are so pronounced that awards can be made with but little consideration. Where competition is close it is well to keep the important factors in mind, and if necessary use them.

The Exhibitor—A practical exhibitor knows the importance of thoroughly understanding the rules and regulations as well as the schedule of the exhibition in which he is to compete, and generally masters these prior to the date. In classes which specify certain colors such as white, pink, yellow, etc., it is advisable to select a variety that is most perfect in this respect, avoiding those that are shaded or marked with other colors. Never be confident of success before your blooms are staged or at least until you have seen those of your competitors.

Remember that judging to a certain degree is based upon individual preference, and judges, like others, do not all see the same. The decision may be at a variance with your opinion, but whether right or wrong, do not abuse the judge, or criticise his actions too severely. If you are satisfied there is something radically wrong and your exhibit has not been given just consideration, enter a protest. This should be made in writing, setting forth the grounds of your grievance. Sign and hand to the secretary to lay the matter before the judge.

Abide by the rules and regulations and never resort to trickery of any kind to gain a point. Such a course cannot succeed long at best, and it would be humiliating to have an exhibit disqualified by such a procedure.

CHAPTER XVI.

CLASSIFICATION



FIG. 32. INCURVED

As very few schedules include classes for specific types, knowledge pertaining to classification has not been fully promulgated and accepted as an important adjunct to Chrysanthemum culture. And further, the hybridist has so crossed and re-crossed some of the sections, that the identity is often rather obscure.

Chrysanthemums possessing certain characteristics of form and petalage are grouped into classes, according to these peculiarities.

The following are abridged descriptions of various types as adopted by the National Chrysanthemum Society of England:



FIG. 33. JAPANESE.

Incurved—The distinguishing characteristics are the globular form and regular outline of bloom. They should be as near a globe as possible, the florets broad, smooth, rounded at the tips, and regularly arranged. A hollow center or eye, or unevenness of outline is a serious defect. See Fig. 32.

Japanese—No definition can be given to include all the remarkable variations of form found in the Japanese chrysanthemums.

The majority of the leading varieties are so distinctly marked, that nearly every one would require a special definition. Without regarding the colors, the form of the florets and blooms furnish ample means of identification. The florets are either flat, fluted, quilled or tubulated, and of varying length, from short, straight, spreading florets, to long, drooping, twisted, or irregularly incurved ones. See Fig. 33.

Japanese Incurved—No definition can be given to include all the remarkable varieties found in this type. The florets are either flat, fluted, quilled or tubulated and of varying length, from short, straight, and spreading, to long, drooping, twisted, or irregularly incurved. See Fig. 34.

Hairy—The chief peculiarity consists of a covering of short glandular hairs on the reverse of the florets. This hair-like growth is shown to best



FIG. 34. JAPANESE INCURVED.

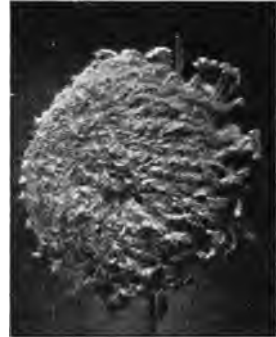


FIG. 35. HAIRY.

advantage where the florets are incurved. See Fig. 35.



FIG. 36. REFLEXED.

Reflexed—The flowers should be perfectly circular in outline, without a trace of thinness in the center, hemispheroidal and with broad, overlapping florets. See Fig. 36.

Large Anemones—The characteristics are large size, high, neatly formed centers and regularly arranged florets, one quilled and forming the center or disc, the other flat and horizontally arranged, forming the border or ray. See Fig. 37.

Japanese Anemones—These are remarkable for their large size and fantastic form. The disc is more or less regular in outline, while the ray florets vary in length, breadth

and arrangement. They may be narrow and twisted, broad and curled, or droop, forming a fringe in some instances.

Pompons—Small blooms, dwarf growth and small leaves distinguish the true Pompons. The blooms are somewhat flat or nearly globular, averaging 1½ inches in diameter; neat, compact with short, flat, fluted florets. See Fig. 38.

Pompon Anemones—These, in style of growth and size, are similar to the Pompons. They are really small flowered Anemones, having a center or disc of quilled and more or less regularly arranged ray florets. See Fig. 39.

Single—These may be any size and form, but should not have more than a double row of ray florets and arranged sufficiently



FIG. 37. LARGE ANEMONE.

close together to form a dense fringe. This section is divided into two classes known as the large and small flowering. See Fig. 40.

The National Chrysanthemum Society of England in their last official catalogue have added the following sections:

Early Flowering Varieties—(A) Large flowering Japanese, (B) Pompons.

Spidery, Plumed, Feathery and Fantastic.

Market and Decorative in three sections, viz.: Early, midseason and late.

The floral committee of the National Society of England have revised the foregoing classifications, but as these have not as yet been approved of, by the Chrysanthemum Society of America, those given above will meet the requirements of persons interested in this subject.

Identifying—Each year flowers are sent to experts for identification, but very few understand how difficult it is to identify them when received in poor condition. Possibly the recipient has been looking at perfect flowers and the specimens received are entirely different as to size, color and other qualifications. Foliage is often the surest means of identification and in submitting samples do not fail to send a few leaves with each specimen.



FIG. 38. POMPON.

If shipped by express see instructions for packing flowers, page —. If sent by mail wrap each bloom with tissue paper and line the box with wax paper to prevent evaporation, and see that the box is of sufficient strength not to be crushed.

Each bloom should be numbered and a record kept so they can be reported upon in like manner.

The conditions under which Chrysanthemums are grown are so varied and the blooms themselves so distinct that this task is very difficult and often fruitless.

Selection—When viewing the exhibition table, notes are made of the best varieties to be grown the following season. In making these selections it is wise to consider which are most suitable for the desired purpose. The two chief classes are commercial and exhibition—the former should be subdivided as follows: First, where the product is packed and transported to the market and often repacked and reshipped before they reach the consumer; second, those produced for local consumption.

In the first instance those possessing pleasing colors, such as white, pink and yellow; good substance, incurved form and long, strong stems with clean foliage, are the most desirable.



FIG. 39. POMPON ANEMONE.

Those growing for retail trade can include many others for sake of variety. Some of the artistic formed sorts, like Iora, a few Anemones, and Pompons, will add materially to any form of arrangement from an artistic point of view.

The exhibition varieties may also be divided as follows: First, those for collections which are staged singly, and second, those for vases of twelve or more to be staged collectively.

Size is of most importance for collections and as the stems usually do not exceed 16 inches in length, are not so important provided they are strong enough to hold the flowers in an upright position.

For vases, size and colors, superlative in their respective classes are the most important factors. Strong, sturdy stems, well clothed with foliage are most effective and should be taken into consideration.

Many varieties suitable for the commercial grower are equally serviceable for exhibition. Each grower must consider his needs. If the demand is for medium rather than large blooms, it is best to inspect the varieties grown on a commercial place, or rely on the judgment of those who give this matter their constant attention.

Commercially the foreign varieties have met with little favor, as will be seen by referring to any list recommended for this purpose.

They generally require greater attention to produce marketable flowers, than those of American origin. In this country the great demand has been for good commercial sorts and the hybridizer has selected with this in view, while foreign seedlings possessing superior exhibition qualities are most popular.

Do not discard those which do well under your method until experience has thoroughly demonstrated the merits of the newcomers.

Novelties should be tested from year to year, retaining those which show advancement, bearing in mind the American varieties are best for commercial growers and the importations should be carefully considered for exhibition.



FIG. 40. SINGLE.

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